AD-755 369

MAGIC III: AN AUTOMATED GENERAL PURPOSE SYSTEM FOR STRUCTURAL ANALYSIS. VOLUME II. USER'S MANUAL

Stephen Jordan, et al Bell Aerospace Company

Prepared for:

Air Force Flight Dynamics Laboratory
July 1972

DISTRIBUTED BY:



AFFDL-TR-72-42 VOLUME II

MAGIC III: AN AUTOMATED GENERAL PURPOSE SYSTEM FOR STRUCTURAL ANALYSIS

VOLUME II: USER'S MANUAL

STEPHEN JORDAN

JAMES R. BATT

BELL AEROSPACE COMPANY

TECHNICAL REPORT AFFDL-TR-72-42, VOLUME II

JULY, 1972



Approved for public release; distribution unlimited.

Reproduced by
NATIONAL TECHNICAL
INFORMATION SERVICE
US Department of Commerce
Springfield VA 22151

AIR FORCE FLIGHT DYNAMICS LABORATORY AIR FORCE SYSTEMS COMMAND WRIGHT-PATTERSON AIR FORCE BASE, OHIO 45433 When Government drawings, specification, or other data are used for any purpose other than in connection with a definitely related Government procurement operation, the United States Government thereby incurs no responsibility nor any obligation whatsoever; and the fact that the Government may have formulated, furnished, or in any way supplied the said drawings, specifications, or other data, is not to be regarded by implication or otherwise as in any manner licensing the holder or any other person or corporation, or conveying any rights or permission to manufacture, use, or sell any patented invention that may in any way be related thereto.

ট	Mills Section	
*	Adi Esclin	回
YSZEGESER		
Stificatica		
·		
	/availarility co)E3
Dist. 6	131L 855/2 See	111
1	1	
_ ; }	ı	Ì
	1	-

Copies of this report should not be returned unless return is required by security considerations, contractual obligations, or notice on a specific document.

AIR FORCE/56780/18 December 1872-460

Secunty Classification			And the second s
DOCUMENT CONT		•	
(Security classification of little, body of abattact and indexing			
1. ORIGINATING ACT. TEY (Corpo . Nauber)			ECUHITY-CLASSIFICATION
Bell Aerospace Company	7		classified
A Division of Textron	ľ	SP. SKCUP	
Buffalo, New York 14240	ا ا	N/A	A
MAGIC III - An Automated General Pu Analysis - Volume II - User's Manua	rpose Syste 1	m for St	tructura1
4. DESCRIPTIVE HOTES (Typo of report and Inclusive dates) Final Report	-0		
3. AUTHOP(S) (First neals, midale initial, last name)		Allert to control the state of the state of	
Stephen Jordan and James R. Batt			
S. REPORTIDATE	74. TOTAL NO. OF	PAGES	75. HO. OF HEFE
August, 1972			! _
MA. CENTRACT OR GRANT NO.	S'ROTANIDIRO AL		
AF 33615-71-C-1390	AFFDL-TR-	.72-42 -	Volume II
a. PROJECT NO.		•	
146?			
. Task No.	168. OTHER REPOR	T NO(3) (Any DE	ther numbers that may be excigned
146702	this report)	*	
d.	1		
10. CISTRIBUTION STATEMENT	<u> </u>		
This document has been approved for distribution is unlimited.			,
11. SUPPLEMENTARY NOTES	12. SPONSORING MI	LITARY ACTIV	VITY
None	Air Force	Flight 1	Dynamics Laboratory
None	Structures		
·	Wright-Pat	terson P	AFB, Ohio 45433
13. ABSTRACT			
An automated general purpose s	ystem for a	naryara	ls presenteu.
This system identified by the acron	AM' MAGTO	TTT TOI	r Matrix
Analysis via Generative and Interpr			
of the structural analysis capabili	th avarrant	e in the	s initial

An automated general purpose system for analysis is presented. This system identified by the acronym, "MAGIC III" for Matrix Analysis via Generative and Interpretive Computations, is an extension of the structural analysis capability available in the initial MAGIC System. MAGIC III provides a powerful framework for implementation of the finite element analysis technology and provides diversified capability for displacement, stress, vibration, and stability analyses.

Additional elements have been added to the MAGIC element library in this phase of MAGIC development. These are the solid elements; rectangular prism, tetrahedron, triangular prism, symmetric triangular prism, and triangular ring (asymmetrical loading). Also included are the symmetric shear web element and a revised quadrilateral thin shell element. The finite elements listed include matrices for stiffness. mass, prestrain load, thermal load, distributed mechanical load, pressure and stress.

Documentation of the MAGIC III System is presented in three parts; namely, Volume I: Engineer's Manual, Volume II: User's Manual and Volume III: Programmer's Manual.

13	17	FORM	1	Λ	7	3
IJ	IJ	I NOV 6	, 1	4	•	J

	SurantyClassification	passano ae			نخيسند	·	
14.	COROW FER	HOLE		ROLE		ROLE	× C
1.	Structural Analysis						
2.	Matrix Methods						,
3.	Matrix Abstraction						
4.	Digital Computer Methods	,					
5.	Finite Element Techniques			,			
			,				
		·			,		
		ĺ					,
					·		,
					,		
				,		,	
							,
							, ,
							,
			•				
					,		,
							,
					,		
		,					,
	•						
j							,
		1				,	
			,				
			,				
,	Ib				,		
	D			L		i	

Unclassified

Security Classification

MAGIC III: AN AUTOMATED GENERAL PURPOSE SYSTEM FOR STRUCTURAL ANALYSIS

VOLUME II: USER'S MANUAL

STEPHEN JORDAN JAMES R. BATT

Approved for public release; distribution unlimited.

IIa

FOREWORD

This report was prepared by Textron's Bell Aerospace Company (BAC), Buffalo, New York under USAF Contract No. F-33615-71-C-1390. This centract is an extension of previous work initiated under Project No. 1467, "Structural Analysis Methods", Task No. 146702, "Thermal Elastic Analysis Methods". The program was administered by the Air Force Flight Dynamics Laboratory (AFFDL) under the cognizance of Mr. G.E. Maddux, AFFDL Program Manager. The program was carried out by the Structural Systems Department, Bell Aerospace Company during the period 15 March 1971 to 15 March 1972 under the direction of Mr. Stephen Jordan, BAC Program Manager.

This report, "MAGIC III: An Automated General Purpose System for Structural Analysis" is published in three volumes, "Volume I: Engineer's Manual", "Volume II: User's Manual", and "Volume III: Programmer's Manual". The manuscript for Volume II was released by the authors in July 1972 for publication as an AFFDL Technical Report.

The authors wish to express appreciation to colleagues in the Advanced Structural Design Technology Section of the Structural Systems Department for their individually significant, and collectively indispensible, contributions to this affort.

The authors wish to express appreciation also to Miss Beverly J. Dale, and her staff for the expert computer programming that transformed the analytical development into a practical working tool.

This technical report has been reviewed and is approved.

FRANCISCI, MANIK,

Chief, Theoretical Mechanics Branch Structures Division

ABSTRACT

An automated general purpose system for analysis is presented. This system, identified by the acronym, "MAGIC III" for Matrix Analysis via Generative and Interpretive Computations, is an extension of the structural analysis capability available in the initial MAGIC System. MAGIC III provides a powerful framework for implementation of the finite element analysis technology and provides diversified capability for displacement, stress, vibration, and stability analyses.

Additional elements have been added to the MAGIC element library in this phase of MAGIC development. These are the solid elements; rectangular prism, tetrahedron, triangular prism, symmetric triangular prism, and triangular ring (asymmetrical loading). Also included are the symmetric shear web element and a revised quadrilateral thin shell element. The finite elements listed include matrices for stiffness, mass, prestrain load, thermal load, distributed mechanical load, pressure and stress.

The MAGIC III System for structural analysis is presented as an in integral part of the overall design cycle. Considerations in this regard include, among other things, preprinted input data forms, automated data generation, data confirmation features, restart options, automated output data reduction and readable output displays.

Documentation of the MAGIC III System is presented in three parts; namely, Volume I: Engineer's Manual, Volume II: User's Manual and Volume III: Programmer's Manual. The subject document Volume II (User's Manual) is an extension of the primary technical document and contains instructions for the preparation of input data and for interpretation of output data.

TABLE OF CONTENTS

SECT	ION						PAGE
I	INT	RODU	CTIC	M	•		1
	A.	Gen	eral	. Cons	iderat	ions	1
	B.	App	lica	ble M	AGIC D	ocumentation	2
	c.	Sug	mary	of M	anual	Contents	3
II	INP	UT I	O TH	E MAG	ic iii	System	5
	A.	Int	rodu	ction	l		5
	B.	Sya	tem	Input	Data		5
		1.	Gen	eral	Descri	ption thmetic Abstraction	5
		۷.	Ins	truct	ions A	idded to MAGIC III	7
			a. b. c.	Tria Comp Comp when	ngular utatio utatio Trian	of Equations by Cholesky rization on of Triangularized Matrix on of Linear Equation Solution ngularized Matrix is Known	8 8 8
			d.		at Opt Gener		9
					Abstr Subsc Restr Error	raction Instruction ripted Matrix Names rictions Messages .cation	9 10 10 11 11
			e. f.		EN2. ix Par	titioning (DJOIN)	13 14
				(1) (2) (3) (4)	Error	ral raction Instruction r Messages cation	14 14 14 15
			g. h.		ix REF	PLAC Cutter (STRCUT)	15 16
				(1) (2) (3)		ral raction Instructions r Message	16 16 18
		3.	Mat	rix D	ata		19
		4.	USE	R04.			19
			а,	Intr	oducti	.on	19
			ď.		•	nalysis in Core)	22
				(1) (2) (3) (4)	.ANAI	oduction LIC, with .USERO4. LIC. As An Equation Solver Llaneous Uses of .ANALIC.	22 25 29 30
		-			(b)	Output Matrices Input Matrices	30 36
	Prec	edin	g pag	e blar	ik	V	

TABLE OF CONTENTS (CONT.)

SECTION	-		PAGE
•	Âva	itional Abstraction Instructions itable in MAGIC III to Perform uctural Analyses	38
	(1)	Introduction	38
	(2)		39
•	·(ŝ)	Alternate Statics Instruction Sequence Using Triangular Ring with Asymmetric Loading	5ò:
	(4)	Statics Instruction Sequence Using Cholesky Triangularization (STATICS)	60
	(5)	Štatics: Instruction Sequence with Condensation Using Cholesky Triangularization (STATICSC)	63
	(č),	Statics Instruction Sequence with Prescribed Displacements Using Cholesky Triangularization (STATICS2)	67
	(7)	Stability Analysis Instruction Sequence (STABILITY)	70 ⁻
	(8)	Dynamics Analysis Instruction Sequence (DYNAMICS)	76
	(9)	Free-Free Dynamics Analysis Instruction Sequence (DYNAMICSF)	8 <u>2</u>
	(10)	Dynamics Analysis Instruction Sequence with Condensation (DYNAMICSC)	89
•	(11)	Free-Free Dynamics Analysis Instruction Sequence with Condensation (DYNAMICSCF)	92
	d. Age	ndum Level Abstraction Instructions	95
Ç.	Structu	ral Input Data	97
	2. Ele 3. Ele 4. Ele	eral Description ment Temperature Input Section ment Pressure Input Section ment Pre-Strain and Pre-Stress Input Section uped Mass and Free-Free Input Section	97 99 103

TABLE OF CONTENTS (CONTINUED)

SECTION		PAGE
6	. Element Control Data Section	116
7.	. Element Input Section	121
8	. Element Input Description	124
	a. Rectangular Prism b. Tetrahedron c. Triangular Prism d. Symmetric Shear Web e. High Aspect Ratio Quadrilateral f. Triangular Ring (Asymmetrical Load)	124 130 134 144 145
iii i	nput and oùtput of magic itt systèm	163
А	, Géneral Déscription	163
: B ·	. Rectangular Prism Element	163
, C .	. Tetrahedron Élement	197
D.	. Triangular Prism	233
E	. Symmetric Triangular Prism	<u> 2</u> 63
F	. Symmetric Shear Web	288
Ġ.	. Modified Quadrilateral Thin Shell	316
н	. Triangular Ring, Asymmetric Loading	355
ÍŲ Ř	EFERENCES	391
A	ppendix A - User Manual Updates	393
Aı	opendix B - MAGIC Input Data Forms	žofi

FIGURE		PAGE
ŢĹŧl	MAGIC Matrix/Input Data Format	20
II-2	Statics Agendum for Triangular Ring with Asymmetric Loading	41
II-3	Alternate Statics Instruction Sequence for Triangular Ring with Asymmetric Loading	51
îî-4	Statics Instruction Sequence Using Cholesky Triangularization	61
II-5	Statics With Condensation - Cholesky Triangularization	65
11-6	Statics With Prescribed Displacements - Cholesky Triangularization	68
II-7	Stability Agendum Using Cholesky Triangulariza- tion	72
II-8	Alternate Stability Instruction Sequence Using Matrix Inversion	74
îi-9	Dynamics Analysis Instruction Sequence	78
II-10	Free-Free Dynamics Analysis Instruction Sequence	83
ıĭ-iį	Dynamics Analysis Instruction Sequence With Condensation	90
II-12	Free-Free Dynamics Analysis Instruction Sequence with Condensation	93
II-13	Element Temperature Input Data Form	102
ŢI-14	Element Pressure Input Data Form	106
II-15	Element Pre-Strain and Pre-Stress Input Data Form	109
II-16	Lumped Mass and Free-Free Input Data Form	111
II-17	Element Control Data Form	117
II-18	Élement Input Data Form	123
ÌI-19	Rectangular Prism Element	129

Preceding page blank

FIGURE		PAGE
II-20 ·	Tetrahedron Element	133
II-21	Triangular Prism Element	158
II-22 .	Symmetric Triangular Prism Element	139
II-23	Symmetric Shear Web Element	143
II-24	Triangular Ring (Asymmetrical Load)	146
II-25	Harmonic Stress and Displacement Cutput Control	153
II-26	Harmonic Dependent Pressure Loads	157
II-27	Harmonic Dependent Temperature Loads	160

FIGURE		PAGE
III-B.1	Rectangular Prism Element - Cantilever Beam With End Moment, Three Elements	167
III-B.2	Title Information - Rectangular Prism Element, Cantilever Beam	168
III-B.3	Material Tape Input - Rectangular Prism Element, Cantilever Beam	169
III-B.4	System Control Information - Rectangular Prism Element, Cantilêver Beam	170
III-B.5	Gridpoint Coordinates - Rectangular Prism Element, Cantilever Beam	171
III-B.6	Boundary Conditions - Rectangular Prism Element, Cantilever Beam	172
III-B.7	External Loads - Rectangular Prism Element, Cantilever Beam	173
III-B.8	Element Control Datà - Rectangular Prism Element, Cantilever Beam	174
III-B.9	Element Input - Rectangular Prism Element, Cantilever Beam	175
III-B.10	End Card - Rectangular Prism Element, Cantilever Beam	176
III-B.11	MAGIC Abstraction Instruction Listing - Rectangular Prism Element, Cantilever Beam	17.7
III-B.12	Title and Material Data Output - Rectangular Prism Element, Cantilever Beam	179
III-B.13	Gridpoint Data Output - Rectangular Prism Element, Cantilever Beam	180
III-B.14	Boundary Conditon and Finite Element Description Output - Rectangular Prism Element, Cantilever Beam	181
III-B.15	External Load Conditions - Rectangular Prism Element, Cantilever Beam	182
III-B.16	Transformed External Assembled Load Output - Rectangular Prism Element, Cantilever Beam	182
III-B.17	Stiffness Matrix - Rectangular Prism Element, Cantilever Beam	183

FIGURE	•	PAGE
III-B.18	GPRINT of Matrix Loads - Rectangular Prism Element, Cantilever Beam	188
III-B.19	Displacement Matrix - Rectangular Prism Element, Cantilever Beam	189
III-B. 20	Reaction Matrix - Rectangular Prism Element, Cantilever Beam	190
III-B.21	Stress Output, Element No. 1 - Rectangular Prism Element, Cantilever Beam	191
III-B.22	Stress Output, Element No. 2 - Rectangular Prism Element, Cantilever Beam	192
III-B.23	Stress Output, Element No. 3 - Rectangular Prism Element, Cantilever Beam	193
TĬI-B.24	Force Output, Element No. 1 - Rectangular Prism Element, Cantilever Beam	194
III-B.25	Force Output, Element No. 2 - Rectangular Prism Element, Cantilever Beam	195
îii-B.26	Force Output, Element No. 3 - Rectangular Prism Element, Cantilever Beam	196
III-C.Ì	Tetrahedron Element - Cantilever Beam with Pressure Load, Eighteen Elements	201
III-C.5	Title Information - Tetrahedron Element, Cantilever Beam	505
III-C.3	Material Tape Input - Tetrahedron Element, Cantilever Beam	\$0 3
III-C.4	System Control Information - Tetrahedron Element, Cantilever Beam	204
III-C.5	Gridpoint Coordinates - Tetrahedron Element, Cantilever Beam	205
III-C.6	Boundary Conditions - Tetrahedron Element, Cantilever Beam	206
III-C.7	External Loads - Tetrahedron Element, Cantilever Beam	207
iii-c.8	Element Control Data - Tetrahedron Element,	208

FIGURE		PAGE
iii-c.9	Element Pressure Input - Tetrahedron Element, Cantilever Beam	209
III-C.10	End Card - Tetrahedron Element, Cantilever Beam	210
říj-č.11	MAGIC Abstraction Instruction Listing - Tetrahedron Element, Cantilever Beam	2 ì 1
III-C.11A	ANABIC. Abstraction Instruction Lising	213
III-C'IŚ	Title and Material Data Output - Tetrahedron Element, Cantilover Beam	214
ÎII-C.13	Gridpoint Data Output - Tetrahedron Element, Cantilever Beam	215
III.c.14	Boundary Condition and Finite Element Description - Tetrahedron Element, Cantiléver Beam	ķ16
III-Ģ.15	Element Prossure Table Output - Tetrahedron Element, Cantilever Beam	217
III-c.16	Transformed External Assembled Load Column - Tetrahedron Element, Cantilever Pasm	518
III-C.17	Stiffness Matrix Output - Tetrahedron Element, Cantilever Beam	219
III-C.18	GPRINT of Watrix Loads - Tetrahedron Element, Cantilever Beam	224
Iți-c.19	Matrix Loads - Tetrahedron Element, Cantillever Beam	224
III-Ĉ.20	Displacement Matrix - Tetrahedron Element, Cantilever Beam	225
III-Ç.21	Reaction Matrix - Tetrahedron Element, Cantilever Beam	226
III+C.E2	Stress Output, Element No. 1 - Tetrahedron Element, Cantilever Beam	227
III-C.23	Stress Output, Element No. 7 - Tetrahadron Element, Cantilaver Beam	228
III-C.24	Stress Output, Element No. 18 - Tetrahedron	229

FIGURE		PAGE
jri-c.25	Force Output, Element No. 1 - Tetrahedron Element, Cantilever Beam	\$30
FII-C.26	Force Output, Element No. 7 - Tetrahedron Element, Cantilever Beam	231
III-C.27	Force Output, Element No. 18 - Tetrahedron Element, Cantilever Beam	535
III-D.1	Triangular Prism Element - Cantilever Beam with End Moment, Six Elements	236
III-D.2	Title Information - Triangular Prism Element, Cantilever Beam	237
III-D.3	Material Tape Input - Triengular Prism Element, Cantilever Beam	238
ŢIŢ-D.4	System Control Information - Triangular Prism Element, Cantilever Beam	239
III-D.5	Gridpoint Coordinates - Triangular Prism Element, Cantilever Beam	è40
III-D.6	Boundary Conditions - Triangular Prism Element, Cantilever Beam	241
III-D.7	Externel Loads - Triangular Prism Element, Cantilever Beam	5/15
ELLT.	Element Control Data - Triangular Prism Element, Cantiléver Beam	243
III-D.9	End Card - Triangular Prism Element, Cantilever Beam	244
III-D. 10	MAGIC Abstraction Instruction Listing - Triangular Prism Element, Cantilever Beam	2 ¹ 45
III-D,11	Title and Material Data Output - Triangular Prism Element, Cantilever Beam	247
111-D.12	Gridpoint Data Output - Triangular Priam Element, Cantilever Bass	248
HII-D.13	Boundary Condition and Finite Element Description - Triangular Prism Element, Centilever Beam	249

FIGURE		PAGE
FIGURE	and the same of th	~ ·
111-D,14	Transformed External Assembled Load Column - Triangular Prism Element, Cantilever Beam	250
III-D.15	Stiffness Matrix Output - Triangular Prism Element, Cantilever Beam	251
111-D.16	GPRINT of Matrix Loads - Triangular Prism Element, Cantilever Basm	256
111-D.17	Displacement Matrix - Triangular Prism Element, Cantilever Beam	257
111-D.18	Reaction Matrix - Triangular Prism Element, Cantilever Beam	258
III-D.19	Stress Cutput, Element No. 1 - Triangular Prism Element, Cantilever Beam	259
III-D.20	Stress Output, Element No. 6 - Triangular Prism Element, Cantilever Beam	260
III-D.21	Force Output, Element No. 1 - Triangular Prism Element, Cantilever Beam	<u>2</u> 61
III-D.22	Force Output, Element No. 6 - Triangular Prism Element, Cantilevêr Beam	262
III-E.1	Symmetric Triangular Prism Element - Cantillever Beam with End Moment, Six Elements	267
III-E.2	Title Information - Symmetric Triangular Prism, Cantilever Beam	26 8
III-E.3	Material Tape Input - Symmetric Triangular Prism, Cantilever Beam	269
III-E.4	System Control Information - Symmetric Triangular Frism, Cantilever Beam	270
III-E.5	Gridpoint Coordinates - Symmetric Triangular Prism, Cantilever Beam	271
III-E.6	Boundary Conditions - Symmetric Triangular Prism, Cantilever Beam	272
III-E.7	External Loads - Symmetric Triangular Prism, Cantilever Beam	273
sil-E.8	Element Control Data - Symmetric Thiangular Prism, Cantilever Beam	274

FIGURE		PAGE
III-E.9	End Card - Symmetric Triangular Prism, Cantilever Beam	275
III-E.10	MAGIC Abstraction Instruction Listing Symmetric Triangular Prism, Cantilever Beam	276
III-E.11	Title and Material Data Output - Symmetric Triangular Prism, Cantilever Beam	278
HI;-E.12	Gridpoint Data, Boundary Condition and Finite Element Description Output - Symmetric Triangular Prism, Cantilever Beam	279
III-E.13	Transformed External Assembled ad Column - Symmetric Triangular Prism, Cantilever Beam	280
TII-E.14	Stiffness Matrix Output - Symmetric Triangular Prism, Cantilever Beam	281
III-2.15	GPRINT of Matrix Loads - Symmetric Triangular Prism, Cantilever Beam	283
III-E. 16	Displacement Matrix - Symmetric Triangular Priam, Cantilever Beam	283
III-E.17	Reaction Matrix - Symmetric Triangular Prism, Cantilever Boam	283
III-E.18	Stress Output, Element No. 1 - Symmetric Triangular Prism, Cantilever Beam	,284
III-E.19	Stress Output, Element No. 6 - Symmetric Triangular Prism, Cantilever Beam	285
III-E.20	Force Output, Element No. 1 - Symmetric Triangular Prism, Cantalever Beam	286
III-E,21	Force Output, Element No. 6 - Symmetric Triangular Prism, Cantilever Beam	287
III-F.1	Symmetric Shear Web Element - Cantilevered Box Beam	292
III-F,2	Title Information - Symmetric Shear Web, Cantilevered Beam	293
III+F.3	Material Tape Input - Symmetric Shear Web, Cantilevered Beam	59 1 1

FIGURE		PAGE
III-F.4	System Control Information - Symmetric Shear Web, Cantilevered Beam	295
III-F.5	Gridpoint Coordinates - Symmetric Shear Web, Cantilevered Beam	296
ili-F.6	Boundary Conditions - Symmetric Shear Web, Cantilevered Beam	297
ili-F.7	External Loads - Symmetric Shear Web.	598
III-F.8	Element Control Data - Symmetric Shear Web, Cantilevered Beam	299
ılı-F.9	Element Input - Symmetric Shear Web, Cantilovered Beam	300
III-F.10	End Card & Symmetric Shear Web, Cantilevered Beam	3 01
III-F.11	MAGIC Abstraction Instruction Listing - Symmetric Shear Web, Cantilevered Beam	302
III.F.12	Title and Material Data Output - Symmetric Shear Web, Cantilevered Beam	304
III-F.13	Gridpoint Data and Boundary Conditions - Symmetric Shear Web, Cantilevered Beam	305
III-F.14	Finite Element Description - Symmetric Shear Web, Cantilevered Beam	306
III-F.15	Transformed External Assembled Load - Symmetric Shear Web, Cantilevered Beam	306
IÍI-F.16	Stiffness Matrix Output - Symmetric Shear Web, Cantilêvered Beam	<u>3</u> 07.
TIL-F.17	GPRINT of Matrix Loads - Symmetric Shear Web, Cantilevered Beam	<u>3</u> 08
111-F.18	Displacement and Reactions Matrices - Symmetric Shear Web, Cantilevered Beam	309
IÍÍ≒F.19	Stress Output, Element No. 1 - Symmetric Shear Web, Cantilevered Beam	310
ili÷£.20	Stress Output, Element No. 7 - Symmetric Shear Web, Cantilevered Beam	311

FIGURE		PAGE
III-F.21	Stress Output, Element No. 13 - Symmetric Shear Web, Cantilevered Beam	315
III-È,22	Force Output, Element No. 1 - Symmetric Shear Web, Cantilevered Beam	313
III-F.23	Force Output, Element No. 7 - Symmetric Shear Web, Cantilevered Beam	314
TIT-F.24	Force Output, Element No. 13 - Symmetric Shear Web, Cantilevered Beam	315
III-G.1	Modified Quadrilateral Thin Shell Element - Lap Joint Problem	323
III~G.2	Title Information - Lap Joint Problem	324
ījì-g.3	Material Tape Input - Lap Joint Problem	325
ĩĩṛ-g.4	System Control Information - Lap Joint Problem	326
III-G.5	Gridpoint Coordinates - Lap Joint Problem	327
III-G.6	Boundary Conditions - Lap Joint Problem	328
III-G,	External Loads - Lap Joint Problem	329
III-G.8	Element Control Data - Lap Joint Problem	330
eļē-g.9	Element Input Data - Lap Joint Problem	331
ÎȚI-G.10	End Card - Lap Joint Problem	332
IŢŢ=Ğ.Ţ1	MAGIG Abstraction Instruction Listing - Lap Joint Problem	333
IIĮ÷G.12	Title and Material Data Output - Lap Joint Problem	335
III-G.13	Gridpoint Data Output - Lap Joint Problem	336
III-G.14	Boundary Conditions and Finite Element Description - Lap Joint Problem	337
III-G.15	Transformed External Assembled Load Output - Lap Joint Problem	338
III-G.16	Stiffness Matrix - Lap Joint Problem	339
III-G.17	GPRINT of Matrix Loads - Lap Joint Problem	344

FIGURE		PACIE
111-G.18	Displacement Matrix - Lap Joint Problem	345
III-G.19	Reaction Matrix - Lap Joint Problem	346
III-G.20	Stress Cutput, Element No. 1 - Lap Joint Problem	347
III-0,21	Stress Output, Element No. 2 - Lap Joint Problem	348
III-G.22	Stress Output, Element No. 3 - Lap Joint Problem	349
III-G.23	Stress Output, Element No. 4 - Lap Joint Problèm	350
III-G.24	Force Output, Element No. 1 - Lap Joint Problem	351
III-0.25	Force Output, Element No. 2 - Lap Joint Problem	352 ⁻
III-G.26	Force Output, Element No. 3 - Lap Joint Problem	353
III-0.27	Force Output, Element No. 4 - Lap Joint Problem	354
TÌI-H.1	Idealized Thick Walled Disc	364
III-H.2	Title Information, Thick Walled Disc	365
g.k-III	Material Tape Input, Thick Walled Disc	366
III-n.4	System Control Information, Thick Walled Disc	367
III-H.5	Gridpoint Coordinate, Thick Walled Disc	368
III-H.6	Boundary Conditions, Thick Walled Disc	369
ш-н.7	Element Control Data, Thick Walled Disc	370
III-H.8	Harmonic Pressure Load Input. Thick Walled Disc	371

LIST OF TLLUSTRATIONS (CONT.)

FIGURE		PAGE
ÎII-H,9	Designation of Stress and Displacement Output Locations, Thick Walled Disc	372
III-H.10	Title and Material Data Output, Thick Walled Disc	373
III-H:11	Gridpoint Data and Boundary Condition Output, Thick Walled Disc	374
ill-H°15	Finite Element Description Output, Thick Walled Disc	375
<u> 111-н.13</u>	Asymmetric Load Data Output, Thick Walled Disc	376
III-н.14	Harmonic Load Output, Thick Walled Disc	376
ΪΙΙ-Η.15a	Harmonic Stiffness and Nodel Load Matrices for Harmonic, Element No. 1, Thick Walled Disc	377
III-H.15b	Harmonic Stiffness and Nodal Load Matrices for Harmonic, Element No. 1, Thick Walled Disc	378
III-H.16a	Harmonic Stress Coefficients for Element No. 1, Thick Walled Disc	379
літ-н.16b	Harmonic Stress Coefficients for Element No. 1, Thick Walled Disc	380
III-H.17a	Nodal Circle Displacements, Thick Walled Disc	381
III-H.17b	Nodal Circle Displacements, Thick Walled Disc	381
III-H.18a	Nodal Circle Reactions, Thick Walled Disc	382
III-H.18b	Nodal Circle Reactions, Thick Walled Disc	382
III-H.19	Stresses in Element No. 1, Thick Walled Disc	383
III-H.20a	Harmonic Thermal Load Input, Thick Walled Disc	384
III-H.20b	Harmonic Thermal Load Input, Thick Walled Disc (Continued)	.385
III-H.2l	Input-Thick Walled Disc, Non-Axisymmetric Loading	386
III-H.22	Asymmetric Load Data Output, Thick Walled Disc	387
III-H.23	Harmonic Load Output. Thick Walled Disc	387
III-H.24a	Harmonic Stresses for Element No. 1, Thick Walled Disc	388
III-H.24b	Harmonic Stresses for Element No. 1, Thick Walled Disc	389

LIST OF ILLUSTRATIONS (CONT.)

FIGURE		PAGE
III-H.25a	Nodal Circle Displacements, Thick Walled Disc	390
ПП-н.25b	Nodel Circle Displacements, Thick Walled Disc	390
III-H.26	Stresses in Element No. 1, Thick Walled Disc	390

LIST OF TABLES

गुनव ाह		Fycit
<u>,</u>	KABU Scalar Control for ANALIC.	27
ıİ,	Element Classification for ANALIC.	28
III	STATICS Instruction Sequence - Triangular Ring with Asymmetric Loading	44
ĮV	Alternate STATICS Instruction Sequence - Triangular Ring with Asymmetric Loading	54
Å	Dynamics Instruction Sequence (Step By Step Definition)	79
V.Ĩ.	Free-Free Dynamics Instruction Sequence (Step By Step Definition)	85

SECTION I

INTRODUCTION

A. General Considerations

The MAGIC III System for structural analysis is an extension of the MAGIC I and MAGIC II Systems reported in References 1 to 6. All capabilities available in the original systems have been retained and improved upon. Extension of the MAGIC System has been in the following areas:

- (a) Incorporation of four (4) solid finite element representations
 - (1) Rectangular Prism
 - (2) Tetrahedron
 - (3) Triangular Prism
 - (4) Symmetric Triangular Prism
- (b) Incorporation of a triangular cross-section ring finite element which accommodates asymmetric loading.
- (c) Incorporation of a symmetric quadrilateral shear web finite element.
- (d) Incorporation of a quadrilateral thin shell finite element which reflects high aspect ratio usage.
- (e) The addition of miscellaneous arithmetic modules to the System to support the existing computational procedures.
- (f) Incorporation of an additional out-of-core variable bandwidth equation solver based on the modified square-root Cholesky method.
- (g) The addition to the System of a module designated as ANALIC (Analysis In Core) which can be used to perform a complete linearly elastic stress analysis, selected portions of a linear elastic analysis, or as a general purpose equation solver.

B. Applicable MAGIC Documentation

The work reported herein is a discussion (from the User's point of view) of the extensions listed in Section A. This volume, User's Manual (Volume II) is an extension of the MAGIC II User's Manual (Reference 5) and as such is to be used in conjunction with that manual to effectively utilize the MAGIC III System. It is emphasized that all information contained in Reference 5 is directly applicable to MAGIC III without exception and the subject volume can be thought of as a supplement to Reference 5.

In order to avoid any confusion and to save the reader from frequent consultation of the Reference Section at the end of this document, the manuals applicable to the usage and understanding of the MAGIC III System are listed as follows:

Theoretical Documents

- (a) Mallett, R.H. and Jordan, S., "MAGIC: An Automated General Purpose System for Structural Analysis: Volume I. Engineer's Manual, AFFDL-TR-68-56, Volume I, Air Force Flight Dynamics Laboratory, Wright-Patterson AFB, Ohio, January 1969.
- (b) Jordan, S., "MAGIC II: An Automated General Purpose System for Structural Analysis: Volume I. Engineer's Manual (Addendum)", AFFDL-TR-71-1, Volume I, Air Force Dynamics Laboratory, Wright-Patterson AFB, Ohio, May 1971.
- (c) Batt, J.R., and Jordan, S., "MAGIC III: An Automated General Purpose System for Structural Analysis: Volume I. Engineer's Manual", AFFDL-TR-72-42, Volume I, Air Force Flight Dynamics Laboratory, Wright-Patterson AFB, Ohio, April 1972.

User Documents

- (a) Jordan, S., and Gallo, A.M., "MAGIC II: An Automated General Purpose System for Structural Analysis, Volume II. User's Manual", AFFDL-TR-71-1, Volume II, Air Force Flight Dynamics Laboratory, Wright-Patterson AFB, Ohio. May 1971.
- (b) Jordan, S., and Batt, J.R., "MAGIC III: An Automated General Purpose System for Structural Analysis, Volume II. User's Manual", AFFDL-TR-72-42, Volume II, Air Force Flight Dynamics Laboratory, Wright-Patterson AFB, Ohio, April 1972.

Programming Document

(a) Gallo, A.M., "MAGIC III: An Automated General Purpose System for Structural Analysis, Volume III. Programmer's Manual", AFFDL-TR-72-42, Volume III, Air Force Flight Dynamics Laboratory, Wright-Patterson AFB, Ohio, April 1972.

C. Summary of Manual Contents

Section II presents additions to the abstraction instruction library of the MAGIC System, descriptions of new agendums for the ANALIC module, and detailed abstraction instructions required for the analysis of structures using the symmetric triangular ring. Additional preprinted input data sheets have been designed and are explained. Newly implemented finite elements and instructions for their use are discussed in detail.

Section III is devoted to interpretation of the input to and output from the MAGIC III System. Preprinted input data forms are presented for specific example problems which utilize each of the MAGIC III finite element representations. Output from these problems is also displayed and discussed in detail.

Appendix A is included which delinects corrections and updates to the MAGIC II User's Manual (Reference 5). Appendix B is a compilation of all preprinted input data forms required to perform an analysis using MAGIC III.

SECTION II

INPUT TO THE MACIC III STATEM

A. Introduction

The MAGIC III System presents two input data interfaces to the Structural Analyst. The first encountered is referred to se the System Input Data interface. The System data instructs the program as to what operations should be performed during any execution. These operations may be viewed as the interpretive portion of the MAGIC System. For example, the matrix abstraction instructions which are required to perform a structural analysis are System Input Data. All abstraction instructions available to the System prior to MAGIC III are delineated in detail in Reference 5. Instructions added during the MAGIC III development are discussed in detail in the next section.

The second input data interface with the User concerns the Structural Input Data. For example, grid point coordinates and boundary condition information are viewed as Structural Input Data. This problem oriented data accounts for nearly all the effort expended in conducting structural analyses.

As with the matrix abstraction instructions, the bulk of Structural Input Data parameters have been fully documented in Reference 5. Additional preprinted input data forms and specific finite element data for newly implemented elements evolved during the MAGIC III development are included and explained in this Section.

B. System Input Nata

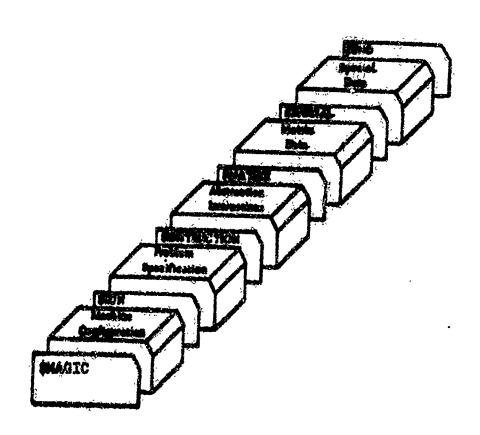
1. General Description

The input data for a general MAGIC execution consists of control and specification data, the abstraction instruction sequence, and problem data. Control, machine configuration and

problem specification data constitute the control and specification data. Matrix and special (non-matrix) data constitute the problem data. These data must be sequenced as follows:

- (1) Machine Configuration Data
- (2) Problem Specification Data
- (3) Abstraction Instruction Sequence Data
- (4) Matrix Data
- (5) Special Deta

where each section is preceded by a control card which indicates the beginning of and the options chosen for that section. The last section is followed by a control card indicating the end of all input to a MAGIC case. A sketch of a typical MAGIC deck set up is shown below.



All MAGIC III data-deck set-ups have the form typified in the sketch. It is noted that all abstraction instruction data is placed behind the \$INSTRUCTION card. All input matrix data is placed behind the \$MATRIX card and all special data is placed behind the \$SPECIAL card. All structural input data such as gridpoint coordinates, element descriptions, temperature and pressure data are classified as special data and as such appear behind the \$SPECIAL card in a data-deck set up.

These data and their relationship to a MAGIC execution are discussed in detail in Reference 5, the companion manual to this document. Of interest here is the additional abstraction instruction capability (Item 3 shove) which has been added to MAGIC III.

2. Additional Arithmetic Abstraction Instructions Added to MAGIC III

The basic form for arithmetic statements is:

 $c = \pm a$.Op. $\pm b$

where \underline{a} and \underline{b} are known matrix names, \underline{c} is the name of the matrix to be computed, Op is the operation to be performed in computing \underline{c} from a and b and the positive signs of a and b may be omitted.

Variations of this basic form are required for certain operations. These variations are described with the corresponding operational definitions when they occur in the following arithmetic statements.

a. Solution of Equations by Cholesky Triangularization Statements are of the form:

T.x = A, B.CHTRIA.

Ax = 1 is the system of equations considered Output matrix T = Triangularized matrix Output matrix x = Solution vector Input matrix A must be symmetric.

b. Computation of Triangularized Matrix

Statements are of the form:

T = A.TRIA.

Input matrix A must be symmetric

Output matrix T = Triangularized form of matrix A

c. Computation of Linear Equation Solution when Triangularized Matrix is Known (Back Substitution).

Statements are of the form:

x = T. CHOL.

Input matrix T is in triangularized matrix form

Input matrix is the known set of constants

Output matrix x = solution of back substitution system

This instruction is especially useful for linear equation solution of Ax = solution when the matrix A has already been triangularized into T. Note also that T matrix must have been generated from a symmetric matrix A.

d. REPEAT

(1) General

The operation REPEAT has been added to the matrix abstraction capability of the system. The new operation provides a looping capability analogous to the FORTRAN "DO" statement where a certain sequence of instructions is to be repeated a specified number of times.

The sequence of instructions to be repeated is expanded into the range of the REPEAT loop during preprocessing, and unique matrix names attained by appending subscripts which are automatically incremented each time the sequence is repeated. Manipulation of subscripted matrices in the instruction sequence prior and subsequent to the REPEAT loop is entirely general and provision is made for the card input of such matrices. In the absence of a REPEAT statement in the sequence of instructions, use of subscripts on matrix names is optional.

Potential applications include synthesis of fullystressed structural designs, analysis of structural nonlinearity due
to large deflections, creep, short-time plasticity and combinations
thereof, 3-dimensional matrix algebra and solutions of systems of
nonlinear equations. REPEAT provides for a more expedient mode
of abstraction instruction input in such applications.

(2) Abstraction Instruction

"Repeat" statements are of the form

REPEAT (n,m)

where the arguments are

- n the number of abstraction instructions in the sequence immediately following the REPEAT statement which are to be repeated
- m the number of times the sequence of n instructions is to be repeated

The instruction can be literally interpreted as "repeat the following series of n instructions m times".

The sequence of instructions is expanded into the range of the REPEAT loop during preprocessing. Matrix names which are initially subscripted automatically have their subscripts incremented by one each time the sequence is repeated; unsubscripted matrix names remain the same.

(3) Subscripted Matrix Names*

Subscripted matrix names are specified in an abstraction instruction as one to six alphameric characters, the first of which must be alphametic (as previously). The subscript of the matrix name, if any, must be a decimal integer between 1 and 9999 enclosed in slashes. If a matrix name is not subscripted, integer one is assumed. Negative or zero subscripts are not allowed.

The matrix name has the form:

NAMEA/k/ or NAMEA

where k is a one to four digit decimal integer.

Subscripted matrix names are specified in card input matrix data by the entry of the matrix name in card columns 67 through 72 (as previously) and the subscript in card columns 73 through 76 (right justified). A modified version of the card input matrix data standard form is shown in Figure II-1, page 20.

(4) Restrictions

Restrictions on the use of the REPEAT loop are as follows:

A statement number may not appear on a statement which lies in the range of a REPEAT loop. This implies there can be no transfer into or within the range of the loop.

The matrix name is stored in memory as one character per word. The seventh word of the matrix name contains a positive or negative integer. The absolute value of this integer is the subscript of the matrix name. The sign of this integer is the sign of the matrix name.

Mesting of REPLAT loops is not persitted.

The total number of statements generated by the REPEAT loop is restricted by the amount of working storage (NWORK) sysilable for the instruction analyzing module and the allocation module. (Typically with NWORK = 10000, approximately 100 instructions are permitted.)

Matrix names on the left side of an equals sign must be subscripted.

(5) Error Messages

Additional control error massages which pertain to the REPEAT module and which emenate from the instruction processor module are listed below.

INSTID STATEMENT NUMBER SPECIFIED WITHIN RANGE OF LOOP, STATEMENT NUMBER IGNORED

INSTIL SYNTAX ERROR IN -REPEAT- INSTRUCTION

INSTI2 MATRIX NAME LEFT OF EQUALS SIGN NOT SUBSCRIPTED WITHIN RANGE OF LOOP

INSTIB INVALID NESTED LOOPS

INST14 SYNTAX ERROR IN SUBSCRIPTED MATRIX NAME

INST15 INSUFFICIENT CORE STORAGE FOR PROCESSING LOOP

instic range of repeat loop is unsatisfied

INST** THIS INSTRUCTION NOT AVAILABLE

Other control error messages which include matrix names as additional descriptive information have been modified to accommodate subscripted matrix names.

(5) Application

As an example of the use of REPEAT consider a nonlinear matrix equation of the form

 $A_0 + A_1 x + A_2 x^2 = 0$ which may be processed iteratively to approximate x as follows:

$$x_{1+1} = -A_1^{-1} (A_0 + A_2 x_1^2)$$

The appropriate abstraction instruction sequence using REPEAT is as follows.

```
1 7
$INSTRUCTION

ATINV = Al INVERS.

X /1/ = ALINV MULT. AO

PRINT(,,,)X/1/

REPEAT (6, 7)

XR /1/ = X /1/.RENAME.

X2 /1/ = XR /1/.EMULT. X /1/

AX2/1/ = A2 MULT. X2 /1/

AAX/1/ = A0 .ADD. AX2/1/

X /2/ = AlINV MULT. AAX/1/

PRINT(,,,)X/2/
```

where matrices AQ, Al, and A2 are either card input or are available on an input matrix data set.

The effective expanded instruction sequence which would result is as follows.

```
$INSTRUCTION
               = -Al INVER
= Alinv MULT.
                          INVERS.
      ALINV
          /1/
      PRINT(,,,)X/1/
               = \chi /1/.RENAME.
      XR /1/
                                   X /1/
X2 /1/
AX2/1/
               = XR /1/.EMULT.
      X2/1/
      AX2/1/
               = A2
                          .MULT.
                          .ADD.
      AAX/1/
                 AO
                  ALINV .MULT.
                                    AAX/1/
          /2/
               =
      PRINT(,,,)X/2/
      XR /2/
               = X /2/.RENAME.
                                   X5 \5\
X5 \5\
X \5\
               = XR /2/.EMULT.
      X2/2/
      AX2/2/
               = A2
                          .MULT.
                          .ADD.
               = A0
      AAX/2/
                                    AAX/2/
         /3/
               = Alinv .MULT.
      PRINT(,,,)X/3/
                = x /7/.RENAME.
               \approx XR /7/.EMULT.
                                    X2 /7/
      AX2/7/
               = A2
                          .MULT,
                                    AX2/7/
      AAX/7/
                  ΑO
                          .ADD.
                  Alinv .MULT.
          /8/
                                    AAX/7/
      PRINT(,,,)X/8/
```

e. EIGEN2

Large Order Eigensolution statements are of the form: $c_1, c_2, c_3, c_4, c_5 = a.EIGEN2. b(d, e, f, g, h, f)$

where <u>d</u> eigenvalues and the corresponding eigenvectors are extracted from the matrix <u>a</u>, the real parts of the eigenvalues and eigenvectors are named matrix <u>c</u>₁ and matrix <u>c</u>₂ respectively, the imaginary parts are named matrix <u>c</u>₁ and <u>c</u>₅ respectively and the residual error is named matrix <u>c</u>₃. The following auxiliary definitions apply with matrix <u>a</u> of order (n x n)

- c₁ is the matrix of real eigenvalues (d x 1)
- c2 is the matrix of real eigenvectors (n x d)
- c3 is the matrix (currently null) of residuals (n x 1)
- c_{ij} is the matrix of imaginary eigenvalues ($\underline{d} \times 1$)
- c5 is the matrix of imaginary eigenvectors (n x d)
- a is the name of the input eigenmatrix (n x n)
- b is the name of an input starting vector (n x l); this represents an approximation of the dominant eigenvector. If b is blank a unit vector is assumed.
- d is the number of eigenvalues requested (an unsigned integer, preférably ≤ 5).
- e is the number of calculation vectors (an unsigned integer > 3 and > d but as small as possible).
- f is the maximum number of iterations (an unsigned integer < 40).
- g is the starting vector recalculation exponent (a signed integer, nominally -2).
- h is the eigenvalue-eigenvector accuracy criterion (an unsigned floating point number with or without exponent, e.g., 1.0E-4)
- i is the eigenvalue uniqueness criterion (an unsigned floating point number with or without exponent, e.g., 1.0E-8).

f. MATRIX PARTITIONING (DJOIN)

(1) Géneral

The base capability for matrix abstraction has been extended by the incorporation of the matrix operation DJOIN (opposite of ADJOIN). This provides for column partitioning of a matrix into two user-named sub-matrices, a capability hitherto effected by post multiplication of the subject matrix by two card extractor matrices.

(2) Abstraction Instruction

Matrix Dejoin statements are of the form:

$$c_{1}$$
, $c_{2} = a.DJOIN.(j,o)$

where the matrix a is column partitioned immediately before its jth column and the resulting dejoined matrices are named c_1 and c_2 (i.e., $c_1 c_2 c_2 = a$). Matrices c_1 and c_2 are of order $(m \times j-1)$ and $(m \times n-j+1)$ respectively with matrix a of order $(m \times n)$. Note that $1 \le j \le n$.

The "O" argument in the statement indicates column dejoining of matrix a. Row dejoining may be effected by initially transposing matrix a. Provisions have been made to accept a "l" in place of the "O" to indicate row dejoin; currently the module will branch to a nonexistent subroutine.

(3) Error Messages

MATRIX COLUMN DIMENSIONS IS TOO SMALL IN .DJOIN.

This error results when the column number, j, is greater than the matrix column dimension, n.

(4) Application

Two example applications are given below.

- (1) X, Y = Z.DJOIN. (40,0)

 If Z is order 300 x 100 then

 X will be of order 300 x 39 and

 Y will be of order 300 x 61
- (2) G, P = H.DJOIN. (1,0)

 G will be a null column with the row dimensions of H, and P will be a copy of H.

g. Matrix REPLAC

Matrix Replace statements are of the form:

 $a = \pm b$.REPLAC.c

where the input matrix b may be of order n x m
the input matrix c may be of order n x m
the output matrix a may be of order n x m

Wherever the elements of matrix b are equal to the corresponding elements of matrix c or wherever elements of matrix c are equal to 0.0, the output matrix a contains a direct mapping of matrix b. However, when the elements of b are not equal to the corresponding elements of matrix c, (excluding c = 0.0), the output elements of the resulting matrix a are equal to those elements of matrix c. This instruction is useful whenever it is desired to form a new matrix a, such that its corresponding elements will be the same as those of matrix b except where modified by elements of matrix c which are not equal to 0.0.

h. STRUCTURE CUTTE. (STRCUT)

(1) General

The matrix abstraction capability of the MAGIC III System includes the "Structure Cutter" module which generates a solution of "n" linear simultaneous equations in "m" unknowns by Jordanian elimination (where n\(\exists\)m). This module takes advantage of sparsity of the coefficient matrix and utilizes a more effective mode of pivot selection.

The user may optionally control the pivotal acceptance levels used by the module and a list of the column numbers of the unreduced (non-pivotal) columns of the coefficient matrix is now included in the unconditional printed output for a successful execution. If execution is terminated for reason of unacceptable pivots the row numbers of the remaining (dependent) equations in which acceptable pivots cannot be found are listed.

The revised module also includes a restart capability which may be deployed should execution be terminated during the pivot selection phase for abnormal reasons; e.g., system malfunction. The four scratch data sets used during execution must be saved if a restart is to be made. Detailed information relating to this module is contained in Reference 7.

(2) Abstraction Instruction

"Structure-Cutter" statements are of the form:

$$c_1$$
, $c_2 = \pm a.STRCUT. \pm b$, (d,e,f,g,h)

where the solution, Y, of the system of "n" linear simultaneous equations in "m" unknowns, $\pm AY\pm B=0$, where $n\leq m$, is formed by Jordanian elimination and the two parts of the solution are named matrix \underline{c}_1 and matrix \underline{c}_2 . The following auxiliary definitions apply:

- a is the transpose of the coefficient matrix. A.
- b is the transpose of the matrix of constants. B.
- ca is the homogeneous solution,
- co is the particular solution.
- d is an unsigned floating point number, with or without exponent, bounding matrix element values of matrices c₁ and c₂ which are trivial and to be suppressed. That is the matrix element c_{ij} is suppressed if c_{ij} 4 d. If d is blank, zero valued elements are suppressed.
- e is either of the two literal constants. STOP or CONT.

 When e is STOP, execution is terminated if the available pivot elements do not satisfy the accuracy requirement. When e is CONT, termination of execution for reason of unacceptable pivot elements is delayed until the STRCUT instruction has been completely executed, including printing. If e is blank, the STOP option applies.
- f is the name of the matrix of weighting factors. If f is blank, a unit matrix of weighting factors automatically applies.
- g is the first pivotal acceptance level. If g is blank, 10^{-3} is used.
- h is the second pivotal acceptance level. If \underline{h} is blank, 10^{-5} is used.

Matrices $\underline{c_1}$ and $\underline{c_2}$ are normal output data for this process. For the case m = n, $\underline{c_1}$ does not theoretically exist. In this case, a null matrix of order $(n \times 1)$ is generated as $\underline{c_1}$.

This subroutine unconditionally prints both a list of pivot element values with the corresponding column numbers of matrix A and a list of the column numbers of the unreduced (non-pivotal) columns of matrix A as special output data.

If execution is terminated for reason of unacceptuble pivot elements the best remaining pivot is printed together with the row number of matrix A from which it emanates. Row numbers for all remaining rows which contain unacceptable pivots are also listed.

(3) Error Message

Error messages emanating from the Structure Cutter are listed below in alphabetical order on the first word.

CANNOT LOCATE MATRIX FOR STRUCTURE CUTTER.

ERROR ÎN STRUCTURE CUTTER ÎNPUT - IMAX = **** AND JMAX = ****

ERROR IN STRUCTURE CUTTER INFUT - NULL COLUMNS MATRIX ***** NULL COLUMN = **** (EIC)

ERROR IN STRUCTURE CUTTER INPUT - NULL ROWS NULL ROW = **** (ETC.)

insufficient storage for structure cutter:

Insufficient tapes for structure cutter

MATRIX IS SINGULAR. BEST UNACCEPTABLE PIVOT = ±0.XXXXXXE-XX EQUATION ****

FOLLOWING EQUATIONS CONTAIN UNACCEPTABLE PIVOTS **** (ETC.)

3. Hatrix Data

Card Input matrix data are specified on the Standard Form shown on the following page, (Figure II-1)

A metrix header card having an H in card column 1, and containing the matrix name and its row and column dimensions, is required for each matrix.

It is noted that columns 73 thru 76 are set saide for subscript information. A blank in these locations indicates that the subscript associated with the matrix in question is equal to the integer one (1). Note that this subscripting option is extremely useful when used in conjunction with the REPRAT abstraction instruction discussed previously.

It is also noted that this revised form is identical to the original form provided for card input matrix data (Pg. 27, Reference 5), with the exception of Columns 73 thru 76. The heading PROG. NO. associated with these columns now reads SUBSCRIPT.

The last card after all \$MATRIX data must contain an E in card column 1 with the rest of the card blank.

Each metrix may contain up to 6000 randomly ordered elements. Machine sortability requires that the sequence number (first three digits) for each matrix is unique and identical in both header and element cards.

4. USERO4

a. Introduction

The fourth user coded module of the program is the structural generator of the MAGIC System.

This .USERO4. instruction plays the most important role in MAGIC and it is explained in detail on Pages 28 thru 35 of Reference 5, the companion document to this volume.

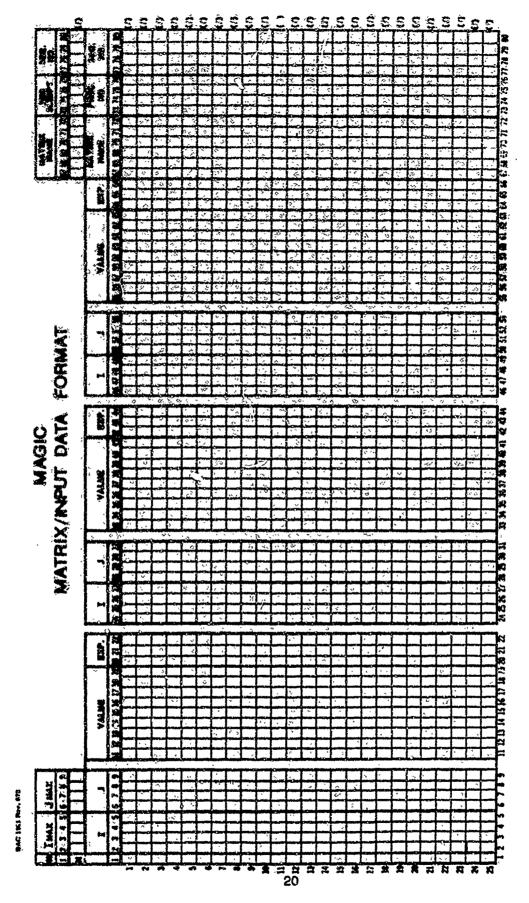


Figure II-1 MAGIC Matrix/Input Data Formst

The Structural Generative System may have as many as fifteen actual output matrices and require as many as four actual input matrices. The basic form of the .USERO4. instruction may be represented as follows:

OMP1, OMP2, OMP3, OMP4, OMP5, OMP6, OMP7, OMP8, OMP9, OMP10, OMP11, OMP12, OMP13, OMP14, OMP15 = IMP1, IMP2, IMP3, IMP4, .USERO4.;

where OMP is read as output matrix position, and IMP as input matrix position. All matrix positions, whether input or output, must be present. They may contain matrix names or be blank, but there must be nineteen matrix positions represented by the appropriate number of commas. Blank matrix positions are discussed in the next section. The output matrix positions, if nonblank, will contain the following matrices upon exit from the Structural Generative System:

OMPl - copy of input structure data deck

OMP2 - revised material library

OMP3 - interpreted input (structure input data as stored after being read and interpreted)

OMP4 - external system grid point loads and load scalar matrix

OMPS - transformation matrix for application of boundary conditions

OMP6 - transformation matrix for assembly of element matrices

OMP7 - element stiffness matrices stored as one matrix

OMPS - element generated load matrices stored as one matrix

OMP9 - element stress matrices stored as one matrix

OMPIO - element thermal stress matrices stored as one matrix

OMPII - element incremental stiffness matrices stored as one matrix

OMP12 - element mass matrices stored as one matrix

OMP13 - structural system constants stored as one matrix

OMP14 - element matrices in compressed format stored as one matrix

OMP15 - prescribed displacement matrix

The input matrix positions, if nonblank must contain the following matrices:

IMPL - structure data deck this would be a previously generated matrix saved in OMPL)

IMP2 - interpreted input (this would be a previously generated matrix saved in OMP3 used for restart)

IMP3 - existing material library (this would be a previously generated matrix saved in OMP2)

TMP4 - displacement or stress matrix to be used for stability analyses (the stress matrix must have been generated by the structural abstraction instruction .STRESS.)

In the explanation of the ANALIC module and in the explanation of the agendum to use the triangular ring for asymmetric loading, the preceding general discussion of the form of the .USERO4. instruction will prove valuable.

b. ANALIC. (Analysis in Core)

(1) Introduction

ANALIC. is a MAGIC III abstraction instruction which can be used in conjunction with the .USERO4. abstraction instruction to perform a complete statics analysis using inscore routines exclusively. This module may also be used to perform selected portions of a static analysis or as a general purpose equation

solver. The ANALIC module is capable of solving problems of approximately 200 reduced degrees of freedom with 18,000 words of we are storage. For problems of this size, ANALIC is significantly faster than the STATICS agendum. This abstraction also features 'dynamic'storage which allows the maximum size problem to fit in core, a choice of four different equation solvers and engineering printout of output matrices.

ANALIC reduces the amount of time required for solution of the statics problem mainly by reducing the overhead involved in many MAGIC abstraction instructions. In the STATICS agendum, each abstraction instruction must be analyzed, devices must be allocated for all input and output matrices, and finally the abstractions must be executed. The execution of these instructions consists of reading input matrices from intermediate devices, computing and then writing output matrices on other intermediate devices. These output matrices will, in general, become input matrices for subsequent abstractions and hence the above process is repeated. ANALIC eliminates the amount of I/O time required above by creating and operating on intermediate matrices in core. The need to write and then re-read information in successive abstraction instructions is eliminated.

The flexibility that is lost by having one abstraction instruction instead of several is made up in part by the suppression feature of the ANALIC instruction. This suppression feature is similar to the corresponding feature in the USERO4. instruction. If an output matrix is not desired, simply leave the name blank and code only the comma to denote the position of this missing matrix. Certain input matrices and scalars may also be left blank to indicate they are not present. For example, it is possible to use ANALIC to (1) generate only element stresses, or (2) calculate element forces and reactions for a prescribed displacement problem, or (3) compute stresses for a substructure analysis.

ANALIC is also flexible in allowing the user to solve the largest possible problem based on the particular elements he is using and the amount of working storage, NWORK, available to the MAGIC III System. The User indicates the maximum number of grid points, NNOM, and the maximum number of rows in the stress matrix, NRSELM, for any element used in the analysis. The values of NNOM and NRSELM for all the elements in MAGIC III can be found in a table below. Storage is allocated dynamically based on NNOM, NRSELM and other input parameters found in the SC matrix. ANALIC determines the amount of storage required and if there is insufficient storage available, it tries to reduce the number of load conditions to make the problem fit. If the problem still does not fit with one load condition, ANALIC returns control to MAGIC III indicating insufficient storage to solve the problem.

The User has the option of selecting from four different equation solvers in ANALIC. The reader is referred to Section III of Reference 9 for a detailed theoretical discussion of each equation solver. All four of these methods are designed and coded to operate on symmetric matrices. The first technique generates displacements by computing the inverse of the symmetric stiffness matrix and then multiplying by the loads. The method of perdering is used to calculate the symmetric inverse. Cholesky triangularization is the third method presently available in ANALIC. This method is probably the most affective method of solving system of equations. The fourth method available is the Gauss Wavefront method of Reference 10. This method was designed specifically for problems arising in linearly elastic stress analyses.

Engineering printout of many interediate results as well as final output matrices is provided by the AMADIC module. The assembled/reduced stiffness matrix and element applied load

column are printed with reference to the original grid points and degrees of freedom. The total load column is also printed as well as the inverse of the stiffness matrix if it is generated. The displacements and reactions are printed corresponding to the system grid points and degrees of freedom. Element stresses and forces are printed with appropriate labels indicating the stress point and degree of freedom or the grid point.

(2) ANALIG, With USBROY.

A complete linearly electic stress analysis which generates displacements, stresses, forces, and reactions can be obtained by using a .USEROS. instruction followed by an .ANALIC. instruction in the \$INSTRUCTION section of a MAGIC data cack. It is noted that two instructions provide essentially the same output as a standard STATICS agendum. (Note Page 41 and 42, Heference 5 for a comparison.)

An example of the use of the ANALIC. instruction in conjunction with the . USERO4. instruction follows:

CC CC CC

1 7 16

\$MAGIC

\$INSTRUCTION SOURCE

,MLIB,,XLD,TR,,KEL,FTEL,SEL,STEL,,,SC,EM,=,,,USERO4.

DISPL,STR,FORCE,REACT=TR,SC,EM,XLD,,,,.ANALIC.(KALC,NNOM,NRSELM)

where for the .USERO4. instruction

MEIB - updated material library

XLD - external load columns with element applied load scalar as first row

TR - transformation matrix from unordered to ordered system

KEL - element stiffness matrices generation control

FTEL - element applied load columns generation control

5/51 - element stress matrices generation control

STEL - element thermal stress columns generation

control

SC - system constants

EM = all generated element matrices stored up columns

and for the ANALIC, instruction

DISPL - system displacements

STR - element stresses

FORCE - element forces

REACT - system reactions

KALC - equation solver calculation control

(See Table I)

NNOM - maximum number of nodes in any element employed

in the analysis (See Table II)

NRSELM - maximum number of rows in the stress matrix

of any element employed in the analysis

(See Table II)

The three scalar values associated with the .ANALIC. module are KALC, NNOM and NRSELM. These scalars may be entered or suppressed. If the scalar is suppressed, the default values defined below will apply. Commas must be entered in any case to show the position of suppressed scalars. Note that scalars 2 and 3 are used in dynamic storage allocation. Selecting values which correspond to the specific problem are better than taking the default values, since larger problems may be run than with the default values.

SCALAR 1 (KALC) - This scalar indicates the method of solving for displacements based on the following Table (Table 1).

1	KALC	Method
	1	SYMMETRIC INVERSE
Å,	.2 >	GAUSS ELIMINATION
Ţ	3	CHOLESKY TRIANGULARIZATION
	4	GAUSS WAVEFRONT
	Anything Else (Default):	CHOLESKÝ TRIANGULÁRIZATÍON

Table I - KALC Scalar Control for ANALIC.

SCALAR 2 (NNOM) - This scalar indicates the maximum number of grid points used for any element in the analysis. The default value is 8. Table II displays the number of grid points associated with each element in MAGIC III.

SCALAR 3 (NRSELM) - This scalar is the maximum number of rows in the stress matrix for any element used in the analysis. The default value is 40. Table II can be used to choose the largest value of NRSELM for any element used in the analysis.

ETÆMENT	IDENT. NUMBER	ŃŅOM	NRSELM
Frame	11	, 3	12
Incremental Frame	13	3	10
Triangular Thin Shell	.20	6	30
Quadrilateral Thin Shell	21	8	40
Quadrilateral Shear Panel	25.	<u> </u>	1
Triangular Plate	27	3.	. 8
Quadrilateral Plate	. 5 <u>8</u>	4	12
Symmetric Shear Web	29	5	1
Toroidal Ring (Shell Cap)	30	. ą	15
High As ct Ratio Quad ceral Thin She	38	8	40
Triangular Cross-Section: Ring	40.	3.	4
Trapezoidal Ring (Core)	41	4	20
Tetrahedron	50	14	6
Triangular Prism (Symmetric Triangular Prism)	51	6	6
Rectangular Prism	52	8	6

Table II - Element Classification for .ANALIC.

(3) .ANALIC. As An Equation Solver

In addition to using the .ANALIC. instruction with the .USERO4. instruction, .ANALIC. can be utilized as an equation solver as follows:

The equation solvers in .ANALIC. are available to use on any system of equations with symmetric coefficient matrices.

$$\begin{array}{cccc} \text{(A)} & \text{(x)} & = & \text{(B)} \\ \text{(NxN)} & \text{(NxM)} & \text{(NxM)} \end{array}$$

The form of the abstraction instruction used in this context is:

$$X_{j,j}$$
 = $s_{j,j,j}$, A_{j} , $B_{j,j}$, ANALIG (KALC, N, M)

where

OUTPUT MATRIX 1(X)	- is the solution vector of order (NxM)
INFUT MATRIX 6(A)	of order (NxN) in full form. Note that matrix A is symmetric
INPUT MATRIX 7(B)	- is the right hand side vector of order (NxM)

SCALAR 1 (KALC) - This scalar indicates the method of solution based on the following Table:

KALC	METHOD
1	SYMMETRIC INVERSE
è	GAUSS ELIMINATION
3	CHOLESKY TRIANGULARIZATION
. 4	GAUSS WAVEFRONT
Anything Else (Default)	CHOLESKY TRIANGULARIZATION

SCALAR 2 (N) - is the order of the system of equations.

SCALAR 3 (M) - is the number of right hand columns.

All matrices and scalars must be entered with the exception of Scalar 1 (KAIC).

(4) Miscellaneous Uses of .ANALIC.

The .ANALIC. module offers considerable flexibility to a User and its generality is examined in detail in this section.

The most general format of an .ANALIC. instruction is as follows:

DISPL,STRESS,FORCE,REACT = TR,SC,EM,XLD,PD,SUBK,
SUBF,SUBL,GDIS.ANALIC.
(KALC,NNOM,NRSELM)

(a) Output Matrices

ANALIC. will generate any combination of the four output matrices DISPL, STRESS, FORCE, REACT based on the following conventions. To generate the output matrix, enter a name in the appropriate position in the instruction: To suppress the matrix generation, do not enter a name; code only the comma which indicates the position of the matrix which is not generated; i.e., if only stresss are desired, and TR, SC, EM, and XLD are the appropriate matrices output by a prior .USERO4. instruction, write:

STRESS,, = TR,SC,EM,XLD,,,,.ANALIC.(3,,)

The format of the output matrices generated by .ANALIC. are as shown on the following pages.

Output Matrix One (DISPL)

Contents

- Displacements in unordered form

Number of Rows

- Number of degrees of freedom in total

system

Number of Columns - Number of load conditions

Column Records

- NDIR*NDEG displacements for each

system grid point

Output Matrix Two (STRESS)

Contents

- Element stress matrices

Number of Rows

- Sum of number of rows in each element

stress matrix

Number of Columns - Number of load conditions

Column Records

- Element stress matrix repeated for

each element

Output Matrix Three (FORCE)

Contents

- Element force matrices

Number of Rows

- Sum of number of degrees of freedom

in each element force matrix repeated

for each element

Number of Columns - Number of load conditions

Column Records

- Element force matrix repeated for

each element

Output Matrix Four (REACTIONS)

Contents

- Reactions

Number of Rows

- Number of degrees of freedom in total

system

Number of Columns - Number of load conditions

Column Records

- NDIR*NDEG reactions for each system

grid point

PORMAT OF OUTPUT MATRIX 1 (DISPL)

Displacements from .ANALIC. module (Unordered formet)

	#1 Load	Los #2	d #***	Load
Node Pt.	NDIR NDEC			
Node Pt. #2	NDES NDIR		2	
Node Pt. #3				
Node Pt.				2
•				
3	·			
•				
Node Pt. #NREF				

Matrix is of the order (MEIS x NL)

where

MSYS = WALF HOLK MORE

M. - number of load conditions

Column records are of the form

ECAD, ZERO, MSYS, (N(I), I+1, REFS)

MARY - number of reference node points

ROBMAT OF OUTPUT MATRIX 2 (UTHEUS)

Element Stress metrix from ARALIC,

	Lord P.	Los	d.	Load
	MEEL ELM F1	3 // 4 %		
entick in the second	THE REAL PROPERTY.	Q.		
	INSEL SISM FI			
WRO ILL				
			A 15 1.	
)))Compromise of the compromise of the compromis				
	MISE Ein Mulin		• *	

Metrix is of the order (NTRSEL x ML) where

HELEN NRSELL

NL = number of load conditions

Column records are of the form

LOAD, ZERO, NTRSEL, (W(I), I=1, NTRSEL)

FORMAT OF OUTPUT MATRIX 4 (REACT)

REACTIONS from .ANALIC. (Unordered format)

	Load #1	Load #2	Load #NL
Node Pt. #1	NDIR * NDEG		Ì
Node Pt. #2	NDIR * NDEG		
Node Pt. #3	NDIR * NDEG		
u	-		
• ,			
•	,		
•		• • • • • • • • • • • • • • • • • • •	·
Node		• • • ·	
Pt. #NREF			,

Matrix is of the order

(NSYS x NL)

where

NSYS = NREF *NDIR*NDEG

NL - number of load conditions

Column records are of the form

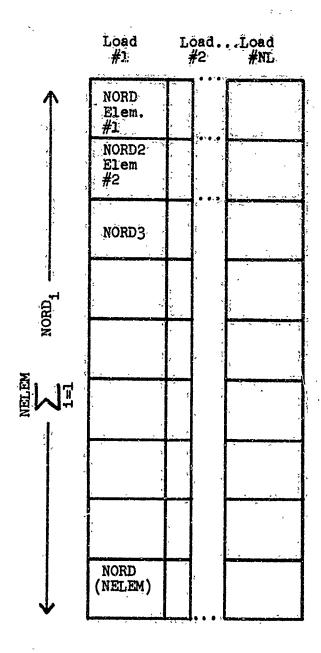
LOAD, ZERO, NSYS, (W(I), I=1, NSYS)

NREF = number of reference node

points

FORMAT OF OUTPUT MATRIX 3 (FORCE)

Element Forces from .ANALIC.



Matrix is of the order (NTELEM x NL)

where

NT = number of load conditions

Column records are of the form

LOAD, ZERO, NTELEM(W(I), I=1, NTELEM)

(b) Input Matrices

There are nine possible input matrices for the .ANALIC. instruction. The first three matrices reflect the element generation information obtained from a .USEROM. Instruction and are required for a complete statics analysis (Section 141.C.:). If .ANALIC. is used as an equation solver only, they are not input (Section III.C.3).

<u>Input Matrix 1 (IR)</u> - Is a transformation matrix which orders the system into the O-1-2 order used by the .ANALIC. instruction. This matrix is usually obtained from output matrix position six of the .USERO4. instruction.

Input Matrix 2 (SC) - Is a vector of system constants generated as output matrix 13 of the .USERO4. instruction.

Input Matrix 3 (EM) - Is a matrix containing the element matrices generated by the .USERO4. instruction. This matrix is output matrix 14 of the .USERO4. instruction.

Input Matrix 4 (XLD) (Optional) - Is a matrix containing the external loading columns generated by the .USERO4. instruction as output matrix 4. This matrix is unordered with load scalar as first row.

Input Matrix 5 (PD) (Optional) - Is a matrix containing prescribed displacements generated as output matrix 15 of a .USER04. instruction. This matrix is unordered.

Input Matrix 6 (SUBK) (Optional) - Is a matrix which contains a stiffenss matrix in one of the following forms:

(a) If input matrix 8 is not present, SUBK is a stiffness matrix of order MxM, M ≤ N where N is the order of the reduced stiffness matrix generated in the .ANALIC. module. This matrix must be ordered the same way that the stiffness matrix in .ANALIC. is ordered. This matrix is added to the stiffness matrix assembled inside .ANALIC..

(b) If input matrix 8 is present, SUBK is a stiffness matrix of order M & N where N is the maximum order of the reduced stiffness generated in the ANALIC, module. This matrix does not have to be ordered the same way that the reduced stiffness matrix is. Input matrix 8 is the transformation matrix which will map the degrees of freedom into the assembled system degrees of freedom. SUBK can then be added to the stiffness matrix generated in ANALIC.

Input Matrix 7 (SUBF) (Optional) - Is a matrix which contains applied loads in one of the following forms:

- (a) If input matrix 8 is not present, SUBF is an applied load matrix of order (Mxl) M & N where N is the order of the assembled/reduced applied load column. This matrix must be ordered the same way as the assembled/reduced applied load column in .ANALIC...
- (b) If input matrix 8 is present, SUBF is an applied load column of order M ≤ N where N is the order of the applied load column used in .ANALIC.. This matrix may be unordered as long as input matrix 8 is present to order this matrix the same way as the assembled applied load column in .ANALIC.. SUBF can then be added correctly to the applied load column inside .ANALIC.

Input Matrix 8 (SUBL) (Optional) - Is a matrix which maps input matrices six and/or seven into the assembled system used inside .ANALIC.. This matrix is of order Mxl where M is the order of input matrices seven and eight.

Input Matrix 9 (GDIS) (Optional) - Is a matrix which is reserved for future system use. It has no meaning presently for ANALIC. See Reference 8, Programmer's Manual for the procedure required to add a new equation solver to the ANALIC. module.

KALC, NNOM and NRSELM were explained in detail in Section III.C.2.

- c. Additional Abstraction Instructions Available in MAGIC III to Perform Structural Analyses
 - (1) Introduction

In the MAGIC II System for Structural Analysis, the procedure for performance of the following types of analyses was described in detail on Pages 39 thru 92 of Reference 5, the companion volume to the subject document.

- 1. Statics
- 2. Statics With Condensation
- 3. Statics With Prescribed Displacements
- 4. Stability
- 5. Dynamics (Modes and Frequencies)
- 6. Dynamics With Condensation

In the subject document, the procedure to perform a linearly elastic stress analysis using the triangular ring which accommodates asymmetric load will be discussed and explained in detail. In addition, additional Agendums for conventional linear elastic static analysis, statics analysis with condensation, static analysis with prescribed displacements, elastic instability analysis, dynamic analysis (with and without condensation) and free-free dynamic analysis (with and without condensation) are listed.

The analyses listed above may be performed in two different ways. In the first the User can elect to place the proper set of abstraction instructions in front of his structural input data deck for any given analyses. The second option, utilizes the Agendum Level abstraction capability which has been incorporated into the MAGIC II and MAGIC III Systems. Using this option, the abstraction instructions for the type of analyses desired are automatically generated by the System when the User specifies the corresponding option on the \$INSTRUCTION Card. This Agendum level capability will be discussed in detail after the presentation and explanation of the newly available abstraction instructions.

(2) Statics Instruction Sequence Using Triangular Ring With Asymmetric Loading (STATICS ASYM)

Figure II-2 presents the suggested set of abstraction instructions for use in performing a linearly elastic displacement and stress analysis using the triangular cross-section ring which accommodates asymmetric loading. This finite element and instruction for its proper use will be explained in detail in the following section. In addition, a sample problem showing the type of input required and the output obtained for this element is presented in Section III.

Before explaining Figure II-2, two key abstraction instructions used in this Agendum are defined.

.HDECO. - Extracts the harmonic dependent element stiffenss matrix and updates the harmonic loop control matrix

Instructions are of the form:

HLC, HM1 = CF, EM, SC. HDECO.

There are two output matrices and three input matrices for this instruction.

Output matrix HLC - is the harmonic loop control matrix Output matrix HML - is the harmonic dependent element stiffness matrix

Input matrix CF - is the input harmonic loop matrix to be updated by this instruction. This matrix is used to form the output matrix HLC

Input matrix EM - is generated by the .USERO4.

instruction and contains all the
element stiffness matrices for all
desired harmonics

Input matrix SC - is generated by the .USER04. instruction and is a matrix of system constants which contains such items as the total number of elements and the harmonic number

.HSUM. - Computes the sums of harmonic stress, the sum of harmonic displacements and the sum of reactions.

Instructions are of the form:

SUMS, SUMD, SUMR = SC, INPS, INPD, INPR. HSUM.

There are three output matrices and four input matrices for this instruction.

Output matrix SUMS - is the harmonic sum stress matrix
Output matrix SUMD - is the harmonic sum displacement matrix
Output matrix SUMR - is the harmonic sum reaction matrix

SSTATIC SASWI

```
ASSYMMETRIC CROSS SECTION RING ELEMENT ASENDUM
                                                                                          00100010
COUP GENERATE MASTER STIFFNESS MATRIX
                                                                                          00100020
       MATOOTROOKELOFTELOSELOSTELOTOSGOEN, & par auses "4.
                                                                                          00100030
    - NEXT THREE INSTRUCTIONS GENERATE HARMONIC LOOP CONTROL OF MATAIX

CA:CB = SC - DEJOIN: (4:1)
                                                                                          00100040
                                                                                           90100050
       CC, CD . CA .DEJOIN. (3.1)
                                                                                          00100060
       CE, HLC /1/ = CO .DEJOIN. (1,0)
                                                                                          00100070
       TRI TRIZ - TR .DEJOIN. (SCIS,1):11
                                                                                           00100080
       REPEAT ( 13.8)
                                                                                          00120090
       HLC /2/0 EM1 /2/ = HLC /1/, EM, SC &MDECO&
SA1 /1/ = EM1 /2/ .ASSEM. SC. (10)
LA1 /1/ = EM1 /2/ .ASSEM. SC. (4)
RE1 /1/, RE2 /1/ = SA1 /1/ .DEJOIN. (SC(3,1),1)
                                                                                           00100100
                                                                                           00100110
                                                                                           00100120
                                                                                           00100130
       LEL /17, LEZ /1/ = REZ /17 .DEJOIN. 45C(5)11,0)
                                                                                          00100140
       81 /1/2 X1 /1/ = LEZ /1/ .CHTRIA. LAI /1/
                                                                                          00100150
       XX1 /1/ = TR12 . THULT. X1 /1/
                                                                                          00100140
       XO1 /1/ . TR . MULT. XX1 /1/
                                                                                           00100170
                 - EH1 /2/, XO1 /1/ .STRESS. (4,)
       511 /1/
                                                                                          .00100180
       ATT1 /1/ = SA1 /1/ .MULT. XG1 /1/
LB1 /1/ = EN1 /2/ .ASSEM. SC. (40)
                                                                                           00180190
                                                                                           00100200
       ACT1 /1/ = ATT1 /1/ .SUBT. LB1 /1/
                                                                                           00100210
  1F ( HLC /2/ .NULL. ) 60 TO 200
1F ( HLC /2/ .NULL. ) 60 TO 2000
1F ( HLC /3/ .NULL. ) 60 TO 3000
                                                                                           00100220
                                                                                           _0100230
                                                                                           00100240
 2000 SUM1, SUMDI; SUMRI = SC, STI /1/, XXI /1/, ACTI /1/ .HSUM.
                                                                                           00100250
       IF ( HLC /2/ .NULL.) 60 TO 1000
                                                                                           00100260
 3000 ST12 = ST1 /1/ .ADJOIN. ST1 /2/
       ACT12 = ACT1 /1/ .ADJOIN. XX1 /2/
                                                                                           00100270
       X012 = XX1 /1/
                                                                                           00160280
                             ".ADJOIN. ACT1 /2/
                                                                                           00100290
       IF ( HLC /3/ .NULL. ) GO TO 1020
                                                                                           00100300
       ST313 = ST12 . ADJOIN. ST1 /3/
                                                                                           00100310
       X0313 = X012 .ADJQIN. XX1 / 3/
                                                                                           00100320
       ACT313 = ACT12 .ADJOIN. ACT1 /3/
IF ( HLC /4/ .NULL. ) GO TO 1030
                                                                                           00100330
                                                                                           00100340
       ST414 = ST313 .ADJOIN. ST1 /4/
XO414 = XO313 .ADJOIN. XX1 /4/
                                                                                           00100350
                                                                                           00100360
       ACT414 = ACT313 .ADJOIN. ACT1 /4/
                                                                                           00100370
       IF I HLC /5/ .NULL. ) GO TO 1040
                                                                                           00100380
       $7515 = $7414 .ADJOIN. 271 /5/
x0515 = x0414 .ADJOIN. XX1 /5/
                                                                                           00100390
                                                                                          00100400
       ACTS15 = ACT414 .ADJOIN. ACT1 /5/
                                                                                           00100410
       IF ( HLC /6/ . NULL. ) 60 TO 1050
ST616 = ST515 . ADJOIN. ST1 /6/
                                                                                           00106420
                                                                                           00100430
       X0614 = X0515 .ADJOIN. XX1 /6/
                                                                                           00100440
       ACTALA = ACTSLS . ADJOIN. ACTS /6/
                                                                                           00100450
       IF ( HLC /77 .NULL. ) GO TO 1060
ST717 = $T616 .ADJOIN. ST1 /7/
                                                                                           00100460
                                                                                           00100470
       X0717 = X0616 .ADJOIN. XX1 /7/
ACT717 = ACT616 .ADJOIN. ACT1 /7/
                                                                                           00100480
                                                                                           00100490
                                                                                           00100500
       17 ( MLC /8/ .NULL. ) 60 TO 1070
```

Figure II-2 STATICS Agendum for Triangular Ring with Asymmetric Loading 41

1,020 1,030	STULE = ST.77 .ADJGIN. AGENE = XOTLY .ADJGIN. ACTOLO = ACTTLY .ADJGIN. IF (HLC /9/ .NULL.) GG SUMS12, SUM012, SUMR12 = IF (HLC /3/ .NULL.) GG SUMS13, SUMD13, SUMR31 = IF (HLC /4/ .NULL.) GG SUMS14, SUMD14, SUMR41 = IF (HLC /5/ .NULL.) GG	XX1 /8/ &CTI /8/) TO 1080 \$C, \$T12 . TO 1090 \$C, \$T313, TO 1000 \$C, \$T414,	X0313, ACT313		00100540 00100540 00100540 00100550 00100560 00100580 00100580 00100600
1850	SUMSIS, SUMDIS, SUMRSI =		X0515, ACT515	. HSUM .	00100610
1060	IF (HLC /6/ .NULL.) GD SUMS16, SUMD16, SUMR61 = IF (HLC /7/ .NULL.) GD	3C, \$7616,	NOSTE, ACTORS	• HŞUH •	00100620 00100630 00100640
1970	SUMSIT, SUMDIT, SUMRTI . IF I HEC /8/ NULL, I GO.	SC, ST717.	XOTET+ ACTTET	. HSUM .	6010650 0010660
, , ~	SUMS18, SUMD18, SUMRB1 = CAA = CA: «RENAME.	SC. STALE.	XOSIS, ACTAIS	•H\$NH.	00100670 00100680

(Concluded) Figure II-2

- Input matrix SC is a matrix of system constants generated by the .USERO4. Instruction.
- Input matrix INPS is the input stress matrix to be summed. This matrix contains element stresses for each element and for each harmonic.
- Input matrix INFD is the input displacement matrix to be summed. This matrix contains displacements for each harmonic.
- Input matrix INPR is the input reaction matrix to be summed. This matrix contains reactions for each harmonic.

Table III is provided to give explicit definition to the STATICS Agendum for the Triangular Ring with Asymmetric Load illustrated in Figure II-2. Engineering definition for each abstraction instruction which is executed by the System is set forth in detail.

TABÈE III STATICS INSTRUCTION SEQUENCE - TRIANGULAR RING

	(ASSYMETRIC LOADING)
STATÉMENT	
NUMBER	INSTRUCTION AND EXPLANATION
l	,MAT,,,TR,,KEL,FTEL,SEL,STEL,,,SC,EM=,,,.USERO4.
	Generates harmonic numbers, harmonic coefficients, and element matrices for each harmonic number. The controls KEL, FTEL, SEL, STEL must be present to cause these matrices to be generated in FM. MATE is an optional material library maintained by the user. TR and SC matrices are transformation and system control matrices respectively. Statement numbers (2), (3), and (4) generate the harmonic loop control CF for
5	CA,CB = SC.DEJOIN. (4,1)
6	CC,CD = CA.DEJOIN. (3,1)
7	CE, HLC/1/ = CD.DEJOIN. (1,0)
	These statements are needed to generate the harmonic loop control matrix HLC/l/ which has the dimension of 1 x 1. The control number in this matrix should be greater than zero and less than 12.
8	TR1, TR12 = TR.DEJOIN. (SC(5,1),1) $\begin{bmatrix} \frac{TR1}{TR12} \end{bmatrix} = \begin{bmatrix} TR \end{bmatrix}$
	Forms matrix TR12 which when transposed will regenerate the reduced displacement into the non-reduced displacement.
9	Repeat (13,8)
	Generate the following 13 statements 8 times. The index of each matrix will be increased by one for each REPEAT.
10	HLC/2/,EM1/2/=HLC/1/,EM,SC.HDECO.
	Updates the harmonic loop control matrix HLC/l/ by decreasing its control value by one. If the control value is equal to zero, then a null matrix will be output as HLC, otherwise a matrix HLC with the dimension of 1 x 1 will be output.
	Extract the element stiffness matrix EMl from the total set stiffness EM. The extraction is dependent on the harmonic loop control value.

TABLE III (Continued)

STATEMENT NUMBER	THEMPHONTON AND TYPE ANADION
11	INSTRUCTION AND EXPLANATION SAl/1/ = EM1/2/.ASSEM.SC.(10)
	Generates the assembled stiffness matrix SA1/1/ in form of O-1 ordered system for harmonic number one. SC contains system constants which are required by the .ASSEM. modules
18	LA1/1/ = EM1/2/.ASSEM.SC, (4)
	Generates the assembled element applied load column in the O-l ordered system from the harmonic one element stiffness matrix EMI. So contains system constraints which are required by the ASSEM. modules.
13	RE1/1/, RE2/1/ = SA1/1/. DÉJOIN. (SC(5,1),1) $\begin{bmatrix} RE1 \\ RE2 \end{bmatrix} = \begin{bmatrix} SA1 \end{bmatrix}$
	The NMDB rows of SA1 which correspond to the 1's are forwarded in the RE2 matrix.
14	LE1/1/,LE2/1/ = RE2/1/.DEJOIN. (SC(5,1),0) [LE1/1/, LE2/1/] = [RE2/1/] The (NMDB x NMDB) reduced harmonic one element stiffness matrix LE2 is forwarded.
15	B1/1/, X1/1/ = LE2/1/.CHTRIA.LA1/1/
·	Solves for the harmonic one displacements in the reduced system Xl by using Cholesky method to solve the system of simultaneous equation.
16	$XX1/1/ = TR12.TMULT.X1/1/$ $XX1/1/ = [TR12]^T[X1/1/]$ Forms unordered system of displacements.
17	XO1/1/ = TR.MULT.XX1/1/ $[XO1/1/] = [TR][XX1/1/]$ Forms 0-1 ordered displacement columns in XO1,
18	ST1/1/ = EM1/2/,X01/1/.STRESS. (4.) Calculates net element stresses for each element.
19	ATT1/1/ = SA1/1/.MULT.X01/1/ ATT1/1/ = [SA1/1/] [X01/1/] To form system displacement vector ATT1 by multiplying the 0-1 ordered displacement vector with the 0-1 ordered stiffness matrix SA1.

TABLE III (Continued)

TABLE III (Continued)				
STATEMENT NUMBER	THE TRUCTION AND SUPLANATION			
50	181/1/ - BM1/2/ASSW.SC,(40)			
,	Generates the system applied load vector LBI/1/ from the element stiffness matrix BMI and the system matrix SC.			
21	ACT1/1/ = ATT1/1/.SUBT.181/1/ ACT1/1/ = [ATT1/1/] - [LB1/1/]			
,	Generates the reaction vector ACTI by substracting the system applied Toad vector from the system displacement.			
22	If (HLC/2/.NULL.) go to 200.			
	Test the harmonic control matrix HLC/2/ for number of harmonic loops.			
23	200 If (HLC/2/.NULL.) go to 2000			
	If the harmonic number is equal to one, then go to statement 25.			
24	If (HLC/3/.NULL.) go to 3000			
	If the harmonic number is greater than one, then go to statement 25.			
25	2000 SUM1, SUMD1, SUMR1 = SC, ST1/1/, X01/1/, ACT1/1/. HSUM.			
	Compute the sum of element stress, the sum of displacements and the sum reactions, and output the sum of element stresses, the sum of displacements and sum of reactions. This statement is used when the harmonic number is equal to one.			
26	If (HLC/2/.NULL.) go to 1000			
	Branch to statement 1000 to terminate the analysis.			
27	3000 ST12 = ST1/1/.ADJOIN.ST1/2/			
	Adjoin the element stress STI/1/ matrix for harmonic one with the element stress STI/1/ matrix for harmonic two.			
28	XO12 = XX1/1/.ADJOIN.XX1/2/			
	Adjoin the system displacement XX1/1/ for harmonic one with the system displacement XX1/1/ matrix for harmonic two.			
.59	ACT12 = ACT1/1/.ADJOIN.ACT1/2/			
	Adjoin the system reaction ACT1/1/ matrix with the system reaction ACT1/1/ matrix for harmonic two.			
,	■			

TALE III (Continue)

ST THERE		
1.49	THE RESERVE OF THE PARTY OF	
50	If (MLC/3/, MALL.) go to 1020.	izi
	That the harmonic control value in the harmonic control matrix MCTI/ for the element stream actricas, the system glaplacement matrices and the system reaction to be adjoined.	
31-34	Aljoin the element stress estrices system size- plerement metrices system rescalon metrices for hermonic one, two, three and test the hermonic value in cereonic control metrix HEC/4/.	200
35 -3 8	Adjoin the element atrees satrices, system dispisce- ment matrices, system reaction satrices for hermonic case, two, three, four and test the hermonic value in hermonic control metrix HLC/5/.	
39-42	Adjoin the element strong matrices, system displacement matrices, system reaction matrices for harmonic one, two, three, four, five and test the harmonic value in harmonic control matrix HLC/6/.	
43~46 .	Adjoin the element stress matrices, system dis- placement matrices, system reaction matrices for harmonic one, two, three, four, rive, six and test the harmonic value in harmonic control matrix HLC/7/.	
47-50	Adjoin the element strees metrices, system dis- placement matrices, system reaction matrices for hermonic one, two, three, four, five, six, seven and test the hermonic value in hermonic control matrix HDDAY.	
51-54	Adjoin the element stress matrices, system dis- placement matrices, system reaction matrices for harmonic one, two, three, four, five, six, seven, eight and test the harmonic value in harmonic control matrix HLC/9/.	The state of the s
55	1020 SUMSIZ, SUMDIZ, SUMRIZ=GC, STIZ, X012, ACTIZ. HSUM. Compute the sum of element stress, the sum of displacements and the sum reactions, and output the sum of element stresses, the sum of displacements and sum of reactions. This statement is used when the harmonic number is equal to two.	

TABLE III (Continued)

STATIBULATE	TABLE III (Continued)
MURDAN	INSTRUCTION AND EXPLANATION
56	If (HLC/3/, NULL) go to 1000
	Branch to statement 1,000 to terminate the analysis.
57	1030 SUMB13,SUMD13,SUMR31-BC,ST313,XO313,ACT313.HSUM.
	compute the sum of alement atress, the sum of dis- placements and the sum reactions, and output the sum of element atresses, the sum of displace- ments and sum of reactions. This statement is used when the harmonic number is equal to three.
58	if (MC/4/. MULL.) go to 2000
	Branch to statement 1000 to terminate the analysis.
59	1040 SUMS14, SUMD14, SUMR41-SC, ST414, XO414, ACT414. HSUM.
	Compute the sum of element strees, the sum of dis- placements and the sum reactions, and output the sum of element streeses, the sum of displacements and sum of reactions. This statement is used when the harmonic number is equal to four.
60	If (HLC/5/.NULL.) go to 1000
	Branch to statement 1000 to terminate the analysis.
61	1050 SUMB15.SUMD15,SUMR51=SC,8T515,X0515,ACT515.HSUM.
	Compute the sum of element stress, the sum of displacements and the sum reactions, and output the sum of element stresses, the sum of displacements and sum of reactions. This statement is used when the harmonic number is equal to five.
62	Ir (HLC/6/.NULL.) go to 1000
	Branch to statement 1000 to terminate the analysis.
63	1060 SUMS16,SUMD16,SUMR61=SC,ST616,X0616,ACT616.HSUM.
	Compute the sum of element stress, the sum of dis- placements and the sum reactions, and output the sum of element stresses, the sum of displacements and sum of reactions. This statement is used when the harmonic number is equal to six.
6L	If (HLC/7/.NULL.) go to 1000
Ì	Branch to statement 1000 to terminate the analysis.
65	1070 SUMS17,SUMD17,SUMR71=SC,ST717,X0717,ACT717.HSUM.
	Compute the sum of element stress, the sum of displacements and the sum reactions, and output the sum of element stresses, the sum of displacements and sum of reactions. This statement is used when the harmonic number is equal to seven.

TABLE III (Concluded)

Statement Number	INSTRUCTION AND EXPLANATION
66	If (HLC/8/.NULL.) go to 1000 Branch to statement 1000 to terminate the analysis.
67	1080 SUMB18, SUMD18, SUMR81-BC, ST818, X0818, ACT818, HSUM. Compute the sum of element stress, the sum of displacements and the sum reactions, and output the sum of element stresses, the sum of displacements and sum of reactions. This statement is used when the harmonic number is equal to eight.
68	CAA - CA.RENAME: This instruction terminates the analysis.

(3) Alternate Statics Instruction Sequence Using Triangular Ring With Asymmetric Loading

Figure II-3 presents an alternate set of abstraction instructions for use in performing a linearly elastic displacement and stress analysis using the triangular cross-section ring which accommodates asymmetric loading. It is noted that the suggested set of instructions presented in Figure II-2 made frequent use of the REPEAT option available to MAGIC III. (Note Statement 9) This REPEAT option was explained in detail on pp. 9 thru 12 of this report.

The instructions presented in Figure II-3 do not make use of the REPEAT option. Consequently, sets of instructions are written separately for each harmonic considered in the analysis. It is noted from Figure II-3 that thirteen statements are required for each harmonic which is considered. (Statements 28 thru 41 for Harmonic Number 2 for instance.) With this in mind, it is suggested that the standard set of instructions from Figure II-2 be utilized for most problems. However, the User has the option (if he prefers) of using the instructions as outlined in Figure II-3 which are given explicit engineering definition in Table IV.

```
C ASSYMMETRIC CROSS SECTION RING ELENSHY
                                                                                                                                                 00100010
C--- SENERATE MASTER STIFFNESS MATRIX
                                                                                                                                                 00100020
            MATHOTR , KEL PTEL SEL STEL , 
                                                                                                                                                 00100030
CHART MEXT THREE INSTRUCTIONS GENERATE HARMONIC LOOP CONTROL OF MATRIX OCTOODSO
           CA. CB = SC .DEUUIN. 14,17
                                                                                                                                                 00100050
           CC.CO = CA .DEJOIN. (3:1)
CE.CF = CO .DEJOIN. (1:0)
                                                                                                                                                 00100050
                                                                                                                                                  0100070
CHILL EXTRACT STIFFNESS MATRIX FROM WASTER STIFFNESS MATRIX
                                                                                                                                                 00169080
                                                                                                                                                 TTE 00090
C--- DECREASED LOOP CONTROL MATRIX BY ONE
     HLC. ENT . CF. EN. SC . HOECO.
                                                                                                                                                 00100100
C---- ASSEMBLE STIFF MATRIX FOR HARMONIC ONE
                                                                                                                                                 00100110
C---- GENERATE SYSTEM APPLIED LOAD FOR HARMONIC ONE
                                                                                                                                                 00100120
                                                                                                                                                 00100130
                                                                                                                                                 00100140
           LAI = ENL JASSEH. SC. (4)
           REL, RE2 = SAL . SEUDIN. (SC(5,11,1)
LEL, LE2 = RE2 . DEJOIN. (SC(5,1),0)
                                                                                                                                                -00100150
                                                                                                                                                 00100160
                                                                                                                                                 20100170
            81, XX = LEZ CHTRIA. EAI
            TRISTRIZ TR SDEJOIN. (SC(5,11,1)
                                                                                                                                                 00100160
            XXI - TRIZ .THULT. XI
                                                                                                                                                 -00100190
           XOL - TR .MULT. XXI
                                                                                                                                                 00100200
                                                                                                                                                 00100210
            STI - ENLS XOL .STRESS. (4)
            ATT1 - SA1 . MULT. XUL
                                                                                                                                                  00100220
                                                                                                                                                  00100230
             ACT1 = ATT1 .SUST. LSI
                                                                                                                                                 00100240
C--- TEST HARMONIC LOOP CONTROL MATRIX
                                                                                                                                                  00100250
           IF ( HLC .NULL.) GO TO 100
                                                                                                                                                 00100260
C---- IF, MORE THAN ONE HARNONIC FOLLOWING THIS PATH
                                                                                                                                                 00100270
            HLC1, EM2 = HLC , EM, SC .HOECO.
                                                                                                                                                 00100280
                                                                                                                                                  00100290
            LAZ = EMZ .ASSEM. SC. (4)
                                                                                                                                                  00100300
                                                                                                                                                 00100310
            RE3, RE4 = SAZ ¿DEJOIN. (SC(5,1),1)
            LE3.LE4 = RE4 .DEJOIN. (SC(5,11.9)
                                                                                                                                                 .00100320
                                                                                                                                                  00100330
            BZ, X2 = LE4 .CHTRIA. LAZ
           XX2 = TR12 . THULT. XZ
                                                                                                                                                  90190340
                                                                                                                                                  00100350
            XO2 - TR .MULT. XXZ
            ST2 = EM2 ,XO2 .STRESS. (4.)
                                                                                                                                                  00100360
            ATTE = SA2 . MULT. XOZ
                                                                                                                                                  00100370
                                                                                                                                                  00100380
            LB2 = EM2 .ASSEM. SC , (40)
             ACT2 - ATTE .SUBT. LB2
                                                                                                                                                  00100390
     --- TEST HARMONIC LOOP CONTROL MATRIX
                                                                                                                                                  00100400
                                                                                                                                                  00100410
          IF ( HLC1 .NULL. ) 60 TO 200
 Seres IF MORE THAN 3 HARHONIC FOLLOWING THIS PATH
                                                                                                                                                  00100420
            HLC2. EMB - HLC1. EM. SC .HOECO.
SA3 - EMB .ASSEM. SC. (10)
                                                                                                                                                  00100430
                                                                                                                                                  00100440
             LAS - ENS .ASSEM. SC. (4)
                                                                                                                                                  20100450
            RES.RE6 = SA3 .DEJOIN. (SC(5.1).1)
LES,LE6 = RE6 .DEJOIN. (SC(5.1).0)
                                                                                                                                                  90100460
                                                                                                                                                  00100570
             B3, X3 = LE6 oCHTRIA. LAS
                                                                                                                                                  00100480
                                                                                                                                                  00106490
             XX3 = TRIZ .TMULT. X3
             XOS - TR .MULT. XX3
                                                                                                                                                  00100500
                                                                                                                                                  00100510
             ST3 = EMB, XO3 . STRESS. (4.)
             ATTS - SAS .MULT. XOS
                                                                                                                                                  00100520
             LB3 - EM3 .ASSEM. SC . 4401
                                                                                                                                                  00100530
             ACTS = ATTS .SUBT. LB3
IF ( HLC2 .NULL. ) GO TO 200
                                                                                                                                                  00100540
                                                                                                                                                  00100550
             HLC3, EN4 = MLC2, EM, SC . MOECO.
                                                                                                                                                  00100560
             SAL = EMA .ASSEM. SC. (10)
LAA = EMA .ASSEM. SC. (4)
RETIRES = SAA .DEJUIM. (SC(5)1).1)
                                                                                                                                                  00100570
                                                                                                                                                  00100560
                                                                                                                                                  00100390
             LET.LES - REG .DEJOIN. (SC(5.1).0)
                                                                                                                                                  00100600
```

Figure II-3 Alternate STATICS Agendum for Triangular Ring

```
NA TRIZ TIMET XX4
                                                                                                00100610
                                                                                                00100620
                                                                                              00100630
574 # EM 104 .STRESS. 44.1
                                                                                                00100640
ATTA . SA4 .ME.T. XO4
                                                                                                00100650
LB4 - EN .ASSEN. SC . (40)
                                                                                                -00100660
ACT4 ATT4 .SUST. LB4

IF ( HC3 .NULL. ) EG TO 200

MLC4, EMS — HLC3, EM, SC .HOECO,

SAS — EMS .ASSEM. SC, (4)
                                                                                                00100670
                                                                                              08 200 1000
                                                                                                00100690
                                                                                               00100700
                                                                                                *00100710°
REP.RELO- SAS .DEJOIN. (SC(5,1).1)
LEP.LE10- RED .DEJOIN. (SC(5,1).0)
                                                                                                00100720
                                                                                                00100730
85, X5 = LELO. CHTRIA. LAS
                                                                                                00100740
XXS = TRIZ TMULT. XS
XOS = TR MULT. XXS
STS = EMS XOS STRESS. (4.)
ATTS = SAS MULT. XOS
                                                                                                00100750
                                                                                                00100760
                                                                                                00100770
                                                                                                00100780
105 = EMS .ASSEM. SC . 1407
                                                                                                00100790
ACTS - ATTS . SUOT. LOS
                                                                                                00100800
IF I HLE4 . MULL: 1 50 TO 200
                                                                                                00100610
HLCS, ENG = MLCA, EM, SC .MDECO.

SA6 = EM6 .ASSEM. SC. (10)

LA6 = EM6 .ASSEM. SC. (4)

RE31, RE12 = SA6 .DEJOIN. (SC(5,1),1)

LE11, LE32 = RE12 . DEJOIN. (SC(5,1),0)
                                                                                                00100650
                                                                                                00100630
                                                                                                00100840
                                                                                                00100850
                                                                                                00100660
Be. X6 . LE12 .CHTREA. LAG
                                                                                                00100070
XX6 = TR12 .THULT. X6
                                                                                                00100280
XOS - TR .MULT. XX6
                                                                                                00100690
ST6 = EM4, X04 . STRESS. (4.)
                                                                                                00100900
ATT6 - SA6 .NULT. XO6
                                                                                                00100910
LB6 = EM6 . ASSEM. SC. (40)
ACT6 . ATT6 . SUBT. LB6
                                                                                                00100920
                                                                                                00100930
IF & HLCS . MULL. ) GO TO 200
HLCS, EM7 - MLCS, EM, SC . MOSCO.
SA7 - EM7 . ASSEM. SC, (10)
                                                                                                00100940
                                                                                                00100950
                                                                                                00100960
LAT = ENT . ASSEM. SC. (4)
REL3.RE14 = SAT . DEJOIM. (SG(5.1).1)
                                                                                                00100970
                                                                                                00100980
LEIB, LEI4 = REI4 . DEJOIN. (SCIB, 1), O)
B7, X7 = LEI4 . CHTRIA. LAY
XX7 = TRIZ . THULT. X7
                                                                                                00100990
                                                                                                00101000
                                                                                                00101010
XO7 = TR . MULT. XXT
                                                                                                00101020
ST7 = ENT. XOT .STRESS. (4.)
                                                                                                00101030
ATTT - SAT .MULT. XOT
                                                                                                00101040
LR7 # ENT .ASSEM. SC. 140)
                                                                                                00101050
ACTY - ATTY .SUST. ABR
                                                                                                00101060
IF ( HLC6 . MULL. ) GC TO 200
HLC7, ENS - HLC6, EN, SC . HDECO.
                                                                                                00101070
                                                                                                00101080
SAS = EMS .ASSEM. SC.(10)
LAB = EMB .ASSEM. SC. (4)
RE15,RE16 = SAS .DEJOIM. (SC(5,1),1)
LE15,LE16 = RE16 . DEJOIM. (SC(5,1),0)
                                                                                                00101090
                                                                                                00101100
                                                                                                00101110
                                                                                                00101120
 SS, XS = LEIA .CHTRIA. LAS
                                                                                                00101130
XXO - TALE . THULT. XO
                                                                                                00101140
XOS = TR .HULT. XXB
STB = EMB. XOB .STRESS. (4.)
ATTS = SAB .HULT. XOB
                                                                                                00101150
                                                                                                00101160
                                                                                                00101170
 LBS = EMS .ASSEM. SC, (40)
                                                                                                00101180
 ACTO - ATTO . SUOT. LOS
                                                                                                00101190
 IF ( MLCT .MULL. ) GO TO 200
                                                                                                00101200
```

```
ST12 = ST1 "ADJOIN. ST2
                                                                             00101210
    XXX = XXI .ADJOIN. XXX
                                                                              00101220
     ACTIZ = ACTI .AOJOIN. ACTZ
                                                                              00101230
     IF F HUCL INCLL. 160: TO 1020
                                                                              00101240
     STRIR = STIR .. ADJOING STR
                                                                              00101250
     EXX .MIGLOA. $10X = E1EOX
                                                                              00101260
     ACT313 - ACT12 ADJOING ACT3
                                                                              00101270
     IF ( HLC2: JULL. )60 TO 1030
                                                                              00101280
     STA14 = ST313.ADJOIN. ST4
                                                                              00101290
     X0414 = X0313.ADJOIN. XX4
                                                                              00101300
     ACT414 = ACT313 LADJOIN. ACT4
                                                                              00101310
     IF & HUC3 . MULL. 160 TO 1040
                                                                              00101320
     st515 = st414. Adjoin. St5
                                                                              00101330
     X0515 = X0414.ADJ01No XX5
                                                                              00101340
                                                                              00101350
     ACT515 = ACT414 . ADJOIN. ACT5.
     IF ! HEC4 . MULL. 160 TO 1050
                                                                              00101360
     ST416 = ST515 .ADJOIN. ST4
                                                                              00101370
     X0616 * X0515 .ADJ@IN. XX6
                                                                              00101380
     ACTALS - ACTSES . ADJOIN. ACTA
                                                                              00101390
     IF (MLC5 . MULL. ) SO TO 1060
                                                                              00101400
     ST717 = ST616 .. ADJOIN. ST7
                                                                              00101410
     X0717 = X0616 .ADJOIN. XX7
                                                                              00101420
     ACT717 - ACT616 SADJOIN. ACT7
                                                                              00101430
     if ( Hick - Mulls ) co to 1070
                                                                              00101440
     STOLO - STYLT .ADJOIN. STO
                                                                              00101450
     XXX .NIOLOA. 7170X = 8180X
                                                                              00101460
     ACTELS = ACT717 .ADJOIN, ACTS
                                                                              00101470
     IF ( HLC7 . NULL. ) 60 70 1080
                                                                              00101480
                                                             . HSUM .
1020 SUNSIZ, SUNDIZ, SUMRIZ = SC, STIZ , XOIZ , ACTIZ
                                                                              00101490
     IF ( HLC1 .NULL. ) 60 TO 1000
                                                                              00101500
1030 SUN513, SUMD13, SUMR31 = SC, ST313, X0313, ACT313 .HSUM.
                                                                              00101510
     IF ( HLC2 .NULL. ) 60 TO 1000
                                                                              00101520
1040 SUNS14, SUND14, SUNR41 = SC, ST414, XD414, ACT414. . HSUM.
                                                                              00101530
IF ( HLC3 . NULL. ) GO TO 1000
1050 SUMS15, SUMD15, SUMR51 = SC, ST515, X0315, ACT515 . HSUM.
                                                                              00101540
                                                                              00101550
     IF ( HLC4 . MULL. ) EO TO 1000
                                                                              00101560
1060 SUMS16: SUMD16: SUMR61 = SC: ST416: X0616: ACY616 - HSUM:
                                                                              00101570
     IF ( HLC5 . NULL. ) GO TO 1000
                                                                              00101580
1070 SUNSTA, SUMDIT, SUNRYL = SC, ST717, X0717, ACT717 .HSUH.
                                                                              00101590
     IF I HECK . MULL. I GO TO 1000
                                                                              00101600
1080 SUMS86, SUMD18, SUMR81 = SC, ST818, X0818, ACT618 . HSUM.

IF ( HLC7 . NULL. ) GO TO 1000

100 SUM1, SUMD1, SUMR1 = SC, ST1, XX1, ACT1 . HSUM.
                                                                              00101610
                                                                              00101620
                                                                              00101630
                                                                              00101640
1000 CAA = CA .RENAME.
```

Figure II-3 (Concluded)

TABLE IV

ALTERNATE STATICS INSTRUCTION SEQUENCE

TRIANGULAR RING - ASYMMETRIC LOADING

STATEMENT NUMBER	INSTRUCTION AND EXPLANATION:
3	MAT, TR, KEL, FTEL, SEL, STEL, , SIC, LM DESERVE.
	Generates harmonic numbers, harmonic coefficients, and element matrices for each harmonic number. The controls KEL, FTEL, SEL, STEL must be present to cause these matrices to be generated in EM. MAT is an optional material library maintained by the user. TR and SC matrices are transformation and system control matrices respectively.
	Statement numbers 2, 3, and 4 generate the harmonic loop control of for
5:	CA, CB=SC. DEJOIN. (4,1)
6	CC, CD=CA.DEJOIN: (3,1)
7	GE, CF=CD. DÈJOIN. (1,0)
	These statement mumbers generate the harmonic loop control CF which has the dimension of l x l. The control ramber in this matrix should be greater than zero and less than seven.
1Ô	HLC, EM1=CF, EM, SC. HDECO
	Updates the harmonic loop control matrix CF by decreasing its control value by one. If the control value is equal to zero, then a null matrix will be output as HLC; othersive a matrix HLC with the dimension of 1 x 1 will be output.
	Extract the element stiffness matrix EM1 from the total set stiffness EM. The extraction is dependent on the harmonic loop control value.
12	SAI=EMì.ASSRM.SG (10)
	Generate the assembled stiffness matrix SAl in form of O-l ordered system for harmonic number one. Contains system constraints which are required by the ASSEM. modules.
14	LAI= EMI.ASSEM.SC, (4)
,	Generates the assembled element applied load column in the O-l ordered system from the harmonic one element stiffness matrix EMl. SC contains system constants which are required by the .ASSEM. modules

TABLE IV - (CONTINUED)

STATEMENT NUMBER	INSTRUCTION AND EXPLANATION
15	REL, REZ-SAL. DEJOIN. (SC(5,1),1)
	REI = [SAI]
;	The NMDB rows of SAL which correspond to the 1's are forwarded in the RE2 matrix.
16	LE1, LE2 = [RE2]
,	The (NMDB x NMDB) reduced harmonic one element stiffness matrix LE2 is formed.
.17	el,xl=ie2.chtria. Lal
	Solves for the harmonic one displacements in the reduced system XI by using Cholesky method to solve the system of simultaneous equations.
18	TRI, TRI2=TR.DEJOIN: (SC(5,1),1)
ĺ	TRIZ = [TR]
	Forms matrix TRI2 which when transposed will regenerate the reduced displacement X1 into the non-reduced displacement XXI.
19	XXI = TR12.TMULT.X1
	$xx1 = [TR12]^T [xx]$
	Forms unordered system of displacements.
20	XO1 = TR.MULT.XXX [XO1] = [TR] [XX1] Forms O-1 ordered displacement columns in XO1.
21	STI = EM1, XO1.STRESS. (4,) Calculates net element stresses for each element
22	ATT1 = SA1.MULT.XO1 ATT1 = [SAI] [XO1]
,	Forms system displacement vector ATT1 by multiplying the 0-1 ordered displacement vector with the 0-1 ordered stiffness matrix SA1.

TABLE IV - (CONTINUED)

TABLE IV: - (CONTINUED)			
STATEMENT NUMBER	INSTRUCTION AND EXPLANATION		
23	LB1 = EM1.ASSEM.SC, (40)		
	Generates the system applied load vector LB1 from the element stiffness matrix EM1 and the system matrix SC.		
24	ACT1 = ATT1, SUBT.LB1 ACT1 = [ATT1] - [LB1]		
	Generates the reaction vector ACT1 by subtracting the system applied load vector from the system displacement.		
26	If (HLC.NULL.) go to 100.		
,	Test the harmonic control matrix HLC for number of harmonic loops.		
28-41 Statements 28 thru 41 are used for computations the second harmonic, when the harmonic convalue is dependent on the harmonic control matrix HLC. The explanations for the Statements 10 the same as Statements 10 the same a			
43~55	Statements 43 thru 55 are used for computation of the third harmonic dependent on the harmonic control matrix HLCl. The explanations 1 r the Statements 43 thru 55 are the same as Statements 10 thru 26.		
56-68 ·	Statements 56 thru 68 are used for computation of the fourth harmonic dependent on the harmonic control matrix HLC2. The explanations for the Statements 56 thru 68 are the same as Statements 10 thru 26.		
69-81	Statements 69 thru 81 are used for computation of the harmonic 5 when the harmonic control value in the harmonic control matrix HLC3 is greater than zero. The explanations for Statements 69 thru 81 are the same as Statements 10 thru 25.		
82 - 94	Statements 82 thru 94 are used for computation of harmonic 6 when the harmonic control value in the harmonic control matrix HLC4 is greater than zero. The explanations for the Statements 82 thru 94 are the same as the Statements 10 thru 26.		
95-107	Statements 95 thru 107 are used for computation of harmonic 7 when the harmonic control value in the harmonic control matrix HI.C5 is greater than zero. The explanations for Statements 95 thru 107 are the same as for Statements 10 thru 26.		

TABLE IV (CONTINUED)

STATEMENT NUMBER	INSTRUCTION AND EXPLANATION
108-120	Statements 108 thru 120 are used for computation of harmonic 8 when the harmonic control value in the harmonic control matrix HLC6 is greater than zero. The explanations for Statements 108 thru 120 are the same as for Statements 10 thru 26.
121	200 ST12 = ST1.ADJOIN.ST2
	Adjoin the element stress ST1 matrix for harmonic one with the element stress ST2 matrix in harmonic two.
122	XO12 = XX1.ADJOIN.XX2
	Adjoin the system displacement XX1 for harmonic one with the system displacement XX2 matrix for harmonic two.
153	ACT12 = ACT1.ADJOIN.ACT2
	Adjoin the system reaction ACT1 matrix with the system reaction ACT2 matrix for harmonic two.
124	If (HLC1.NULL.) to go 1020.
	Test the harmonic control value in the harmonic control matrix HLCl for the element stress matrix, the system displacement matrices and the system reaction matrix to be adjointed.
125-128	Adjoin the element stress matrices, system displacement matrices, system reaction matrices for harmonic one, two, three and test the harmonic value in harmonic control matrix HLC2.
129-132	Adjoin the element stress matrices, system displacement matrices, system reaction matrices for one, two, three, four and test the harmonic value in harmonic control matrix HLC3.
133-136	Adjoin the element stress matrices, system displacement matrices, system reaction matrices for harmonic one, two, three, four, five and test the harmonic value in harmonic control
137-140	Matrix HLC4. Adjoin the element stress matrices, system displacement matrices, system reaction matrices for harmonic one, two, three, four, five, six and test the harmonic value in harmonic control matrix HLC5.

TABLE IV - (CONTINUED)

TABLE IV -(CONTINUED)				
STATEMENT NUMBER	INSTRUCTION AND EXPLANATION			
141-144	Adjoin the element stress matrices, system displacement matrices, system reaction matrices for harmonic one, two, three, four, five, six, seven and test the harmonic value in harmonic control matrix HLC6.			
145-148	Adjoin the element stress matrices, system displacement matrices, system reaction matrices for harmonic one, two, three, four, five, six, seven, eight and test the harmonic value in harmonic control matrix HLC7.			
149	1020 SUMS12,SUMD12,SUMR12=SC,ST12,X12,ACT12.HSUM.			
	Compute the sum of element stress, the sum of displacements and the sum of reactions and output the sum of element stress, the sum of displacements and sum of reactions. This statement is used when the harmonic number is equal to two.			
150	If (HLC1.NULL.) go to 1000			
	Branch to statement 164 to terminate the analysis.			
151-152	These statements are used when the harmonic number is equal to three. For explanation of these statements, see Statements 149 and 150.			
153 - 15 ⁴	These statements are used then the harmonic number is equal to four. For explanation of these statements, see Statements 149 and 150.			
155-156	These statements are used when the harmonic number is equal to five. For explanation of these statements, see statements 149 and 150.			
157-158	These statements are used when the harmonic number is equal to six. For explanation of these statements, see statements 149 and 150.			
159-160	These statements are used when the harmonic number is equal to seven. For explanation of these statements, see statements 149 and 150.			
161-160	These statements are used when the harmonic number is equal to eight. For explanation of these statements, see statements 149 and 150.			

TABLE IV - (CONCLUDED)

STATEMENT NUMBER	INSTRUCTION AND EXPLANATION
163	100 SUM1, SUMD1, SUMRISC, ST1, XO1, ACT1. HSUM.
	This statement is used where harmonic number is equal to one. For explanation of this statement see statement 149.
164	1000 CAA = CA.RENAME.
	Terminates the analysis.

(4) Statics Instruction Sequence Using Cholesky Triangularization (STATICS)

Figure II-4 presents the suggested set of abstraction instructions for use in performing a linearly elastic displacement and stress analysis. This set of instructions differs from those reported on pp. 40 thru 52 of Reference 5 in the following respect.

The set of simultaneous linear equations which arise in the analysis are solved by Cholesky triangularization. The use of these instructions are explained in detail on page 8 of this report.

Statement 47 of Figure II-4 has the following form;

TRIA, XX = STIFF, TLOADR, CHTRIA.

where in Reference 5, the equation solution had the following form:

XX = STIFF.SEQEL.TLOADR

Note Statement 47 of Figure II-C (Page 41) of Reference 5.

It is again emphasized that the User is not restricted to this particular set of instructions. The flexibility of the System allows the use of additional or alternate instructions to accommodate special needs and requirements of the User. All instructions available from MAGIC II (Reference 5) are available in MAGIC III.

	20 B	00000010
BSTAT	163	99000020
Ç	-STATICS AGENDUM HITHOUT PRÉSCRIBED DISPLACEMENTS	000000000
	-2/KIIC2 WASHING HILLORI LUESCHIEEN NISKINGELEWIS	00000000
Ç.	والمساور والمراجع	+00000050
Ç		90000000
C		
Č	STATICS INSTRUCTION SEQUENCE	00000070
Ĕ		00000080
Č	* * * * * * * * * * * * * * * * * * * *	*00000030
0 0 0 0 0 0 0 0		00000100
	GENERATE ELEMENT MÁTRICES	00000110
C		00000120
_	, ML I B. ; XLD, TR. , KEL, FTEL, SEL, STEL. ; SC. EM USERO4.	00000330
C		60000140
Č	WOOD AS A SA SASSE ASSE AS W SE SING METAPA	00000150
Ę	FORM 11 X 11 UNIT AND (1 X 1) NULL MATRICES	00000160
C C C	DETERMINE PRINT FORMAT FOR TYPE OF ELEMENTS USED	00000176
Ç	and the second of the second o	00000180
	II = SC.IDENTC.	00000190
	13 = IleHULLeSC	00000200
	DIFF = Il .SMULT. SC(9.1)	00000210
Č C E		00000220
Ç	ASSEMBLE STIFFNESS MATRIX AND ELEMENT APPLIED LOADS	00000230
E		00000240
	KELA = EN .ASSEM. SC, (10)	00000250
	FTELA = EM .ASSEM .SC. (40)	90000260
_	LSCALE, LOADS = XLD .DEJOIN. (1, 1)	00000270
O O		00000280
Ç	REDUCE STIFFNESS MATRIX AND PRINT	00000290
C		00000300
	KO, KNO = KELA . DEJOIN. (SC(5, 1), 1)	00000310
	(CO, STIFF = KNO.DEJOIN. (SC(5,1),0)	00000320
	Print(force, disp, ,) Stiff	00000330
C C		000 00 34 0
Ç	FURM REDUCED TOTAL LOAD COLUMN	00000350
C		00000360
C	MULTIPLY ELEMENT APPLIED LOADS BY LOAD SCALAR	00000370
	FTELS = FTELA. HULT. LSCALE	00000380
C	TRAYSFORM EXTERNAL LOADS TO 0-2-2 ASSEMBLED SYSTEM	00000390
	LOADO = TR.HULT.LOADS	00000400
C	FORM TOTAL LOAD COLUMNS	00000410
	TLOAD = FYELS-ADD-LOADO	00000420
_	TL.TLOADR = TLOAD.DEJOIN.(SC(\$.1).1)	00000430
C		00000440
C	SOLVE FOR DESPLACEMENTS	00000450
C		00000460
	TRIA, XX = STIFF, TLOADR . CHTRIA.	00000470
	TPO, TR12 = TR. JEJOIN. (SC(5,1),1)	00000480
	X * TR12.THULT.XX	00000490
_	XO = TR.MULT.X	00000500
C	SALOW ARE SPACETONS AND BUNGERS CURE	00000510
C	GALGULATE REACTIONS AND INVERSE CHECK	00000520
C	5 FL FT 6 WFL L VIII & VII	00000530
	REACTS = KELA-MULT-XD	00000540
	REACTP# REACTS.SUBT.TLOAD	00000550
_	IF (DIFF-NULL.) GO TO 10	00000560
C	ANTHE PIPMPHS AND TPR INING PHEFALLS LAIRS AREAS ASSURES	00000570
C	PRINT ELEMENT APPLIED LOADS, EXTERNAL LOADS, DISPLACEMENTS,	00000580
C	REACTIONS AND INVERSE CHECK IN ENGINEERING FORMAT	00000590

Figure II-4 STATICS Instruction Sequence Using Cholesky Triangularization 61

```
-00000600
                                                                                01400000
        ELEMENTS HAVE 1 OR 2 DEGREES OF FREEDOM
                                                                                00000620
                                                                                00000630
     GMR 1 YTS 4000 FX. FY. FZ. MX. MY. MZ. SC. TR "I FTELA"
     GPAINT ( 4. . . FX. FY. FZ. NX. MY. MZ. SC. ) LOADS:
GPAINT ( 2. . . U.V. NOTHETAX THE TAY STHETAZ , SC. ) X.
                                                                                00000640
                                                                                00000650
     GPALYTEL ... FX.FY.FZ.MX.MY.MZ.SC.TA IREACTP
                                                                                000000660
                                                                                00000670
     IF (13.NULL.) GO TO 400
                                                                                08600000
                                                                                00000690
         ELEMENTS HAVE 3 DEGREES OF FREEDOM
                                                                                00000700
19
     GPRINTIA...FR.O.FZ.O.META.O.F1.O.F3.SC,TR IFTELA
                                                                                00000710
     00000720
                                                                                00000730
     GRAINT(1, ,, FR.D.FZ.O.META. O.F1.O.F3.SC.TR JREACTP
                                                                                00000740
                                                                                00000750
                                                                                00000760
         GEVERATE STRESSES AND FORCES
                                                                                00000770
     STRESPEN.XD STRESS. (4.) FURCEP-EN.XD .FORCE. (4.)
                                                                                00000780
                                                                                00000790
```

FIGURE II-4 - (CONCLUDED)

(5) Statics Instruction Sequence With Condensation Using Cholesky Triangularization (STATICSC)

Figure II-5 presents the suggested set of abstraction instructions for use in performing a linearly elastic displacement and stress analysis with condensation. The condensation (reduction) technique is that of Guyan (Reference 11). With the use of this option, the User is provided the flexibility to perform a static analysis utilizing a rational condensation procedure. The only basic difference in abstraction instructions between using the statics with condensation option and the standard statics option is the additional instructions required to form the condensed stiffness matrix, i.e.,

$$[K]_{R} = [K_{11} - K_{12} \quad K_{22} \quad K_{21}]$$

This set of instructions differs from those reported on pp. 53 thru 55 of Reference 5 in the following respects.

In the Agendum presented in this document, the reduced stiffness matrix, $[K]_R$ and the deflections, D1 are found using Cholesky Triangularization. Sequence Numbers 213 thru 217 of the present agendum are as follows:

K22I,KR1 = K22,K12T.CHTRIA. KR2 = K12.MULT.-KR1 KR = K11.ADD.KR2

And upon solving for displacements, Dl, we have: TRIA.Dl = KR.Pl.CHTRIA.

It is noted that in Reference 5, the reduced stiffness matrix, $[K]_R$, and the displacements D1 were obtained as follows. (Note Sequence Numbers 393 thru 398, p. 54, Reference 5.)

K221 = -K22 INVERS. KR1 = K22I MULT.K12T KR2 = K12.MULT.KR1 KR = K11.ADD.KR2 D1 = KR.SEQEL.P1

The suggested set of instructions presented herein avoids the use of inversion to form the reduced stiffness matrix. Additionally, the instruction using SEQEL has been replaced with CHTRIA.

```
J0001630:
SST-ATHESC
                                                                                  20031640
C-4-45TATICS AGENOUM, WITH CONDENSATION
                                                                                  30001:550
                                                                                  33051663
                                                                                 ≱300u1a70
                                                                                  22321682
                                                                                  00001690
                                                                                  00001700
                                                                                 *00001715
                                                                                  00001723
                                                                                  00001730
          GENERATE ELEMENT MATRICES
                                                                                  00001740
                                                                  ...USERO4.
      MUIB, ALDOTRO KELAFTEL SEL STEL NESC, EM. FIA
                                                                                  00001750
                                                                                  00001760
          FORM II X 11 UNIT AND CL X 17 NULL MATRICES
                                                                                  00001770
          DETERMINE PRINT FORMAT FOR TYPE OF ELEMENTS USED .
                                                                                  00001760
      II = SC. IDENTC.
                                                                                  00001790
                                                                                  00001800
      13 = 11. NULL .S.C.
      DIFF * II .SMULT. SC(9:1)
                                                                                  00001810
                                                                                  03001820
CCC
          ASS CHOLE STIFFNESS MATRIX AND ELEMENT APPLIED LOADS
                                                                                  00001830
                                                                                  00001840
      ŘELA = EM .ASSEM. SC.(10)
FTELA = EM .ASSEM .SC.(40)
                                                                                  00001853
                                                                                  00001860
                                                                                  02021872
C
C
                                                                                  J0001883
          REDUCE STIFFHESS MATRIX AND PRINT
                                                                                  02001893
                                                                                  20001902
       KO, KID = KELA . DEJÓSNI ( 3C(5, 11, 1)
                                                                                  00001913
       KCO, STIFF = KNO.DEJD.IN.I. SCI 5, 11,01
       PRINTOFORCE, DISP., ) STIFF
                                                                                  03031923
                                                                                  00001930
CCC
          FORM REQUEED TOTAL LOAD COLUMN
                                                                                  00001940
                                                                                  00001950
       LSCALE LOADS = XLD . DEJOIN . (1, 1)
HULTIPLY ELEMENT APPLIED LOADS BY LOAD "CALAR"
                                                                                  00001960
                                                                                  00001970
                                                                                  00001980
       FTELS = FTELA. HULT.L SCALE
    --- TRANSFORM EXTERNAL LOADS TO ORDERED SYSTEM, FORM TOTAL LOADS
                                                                                  00001993
       LCACO = TR .MULT. LJADS
                                                                                  00002000
     TLCAD = FTELS .ADD. LDACO
--CCNDENSE ASSEMBLED STIFFNESS MATRIX
                                                                                  00002010
                                                                                  00002020
       TUP. BOT * STIFF .DEJOIN. (SC(6,1).1)
                                                                                  00002030
                                                                                  00002040
       K11,K12 = TOP .DEJOIN. (SC16,1),0)
       K12T.K22 = BOT .DEJD IN. (SC(6,1),C)
                                                                                  00032053
                                                                                  00022060
```

```
PO.PIZ # TEOAD .DEJO IN. (SC45)1),1)
                                                                         00002170
C----CONCENSE EXTERNAL LIAD COLUMNS
                                                                         U0002080
     P1. P2 = P12 . DEJO'N. (SCI 6, 17) 11
                                                                          2000221190
                                                                         2002:22
  00002110
                                                                         00002120
     K221.KRI = K22.KI2T .CHTRIA.
                                                                         20005333
     KRZ = KIZ .MULT. - KRI
                                                                         J0082:43
     KP = K11 .ADD. KR2
                                                                         00002350
13012163
     TRIA, DI # KR. PI . CHTRIA.
                                                                         00002175
  ---- SCLVE FOR DISPLACEMENTS DZ
                                                                         00002180
     าก2 `≃ ั
           KRI .MULT. DI
                                                                         00002190
C----FOPM TOTAL DISPLACEMET VECTOR
                                                                         00002200
     DIT . CI .TRANSP.
                                                                         00002210
                                                                         00002220
     DZT # C2 .TRANSP.
     DIE . CIT .ADIDIN. DET
                                                                         00002230
J00J2-243
                                                                         00002250
                                                                         .00002260
     TRO TR 12 . TR. DEJOIN . ( SC(5, 1), 1).
                                                                         00002270
    X + TR12.THULT .XX
                                                                         00002280
     XC - TR. MULT..X.
                                                                         00002290
                                                                         00002300
C
         CALCULATE REACTIONS AND INVERSE CHECK
                                                                         00002310
                                                                          00002323
      REACTS - KELA. MULT.XO
                                                                         00002330
      REACTP REACTS .SUBT .TLOAD
                                                                         00002340
     I'F (DIFF.NULL.) GO TO 10
                                                                         00002350
                                                                         00002360
         PRINT ELEMENT APPLIED LOADS. EXTERNAL LOADS. DISPLACEMENTS.
                                                                         00002379
           REACTIONS AND INVERSE CHECK IN ENGINEERING FORMAT
                                                                         00002383
                                                                         00002393
         ELEMENTS HAVE 1 OR 2 DEGREES OF FREEDOM
                                                                         20002400
                                                                          00002410
      GPRINT (4.0. FX. FY. FZ. MX. MY. MZ. SC. TR ) FTELA
                                                                         00002420
      GPRINT (4,,, FX.FY.FZ.MX.MY.MZ.SC,
                                         1 LOAD S
                                                                         00002430
      GPRINT (2,,,u,v,,w,THETAX,THETAY,THETAZ,SC,)X
                                                                         00002440
      GPRINT (1,,, FX. FY. FZ. MX. MY. MZ. SC, TR IREACTP
                                                                         00002450
      IF (13.NULL.) GO TO 600
                                                                         00002460
                                                                         00002470
         ELEMENTS HAVE 3 DEGREES OF FREEDOM
                                                                         00002483
                                                                         00002490
      GPRINT (4, , , FR. O. FZ. O. MBETA. O. F1. O. F3, SC, TR 1 FTELA
                                                                         -00002500
      GRAINT (4., . FR.O.FZ.O.4 BETA. O.F1. O.F3. SC.
                                                  LOADS
                                                                         00002513
      GPRINT (2,,,U.O. W.O.THETAY.O.W.O.W.,SC, )X
GPRINT (1,,,FR.O.FZ.O.48ETA.O.F1.O.F3,SC, TR )REACTP
                                                                         00002520
                                                                         00002530
                                                                          00002540
         GENERATE STRESSES AND FORCES
                                                                         00002550
                                                                         00002560
                                                                         00002570
 600
     STRESP = EM. XO .STRESS. (4, )
      FCRCEP = EM, XO .FORCE. (4,)
                                                                         00002580
```

(6) Statics Instruction Sequence With Prescribed Displacements Using Cholesky Triangularization (STATICS2)

Figure II-6 presents the suggested set of abstraction instructions for use in performing a linearly elastic displacement and stress analysis with prescribed displacements. With the use of this option, applied loading may be prescribed in terms of non-zero displacement values. The number of prescribed displaced grid points is the number of grid points that are assigned known values of displacement other than zero.

This set of instructions differs from those reported on pp. 56 thru 68 of Reference 5 in the following respect. The set of simultaneous linear equations which arise in the analysis are solved by Cholesky triangularization. Statement 127 of Figure II-6 has the following form:

TRIA,XI = KII,K4.CHTRIA.

where in Reference 5, the equation solution had the following form:

X1 = K11.SEQEL.K4

Note Statement 127 of Figure II-e (Page 58) of Reference 5.

```
00000830
SSTATICS2
                                                                              00000610
C-----STAPICS AGENOUM, HITH PRESCRIBED DISPLACEMENTS
                                                                              000000820
                                                                              000000830
C
         STATICS INSTRUCTION SEQUENCE
                                                                              94600000
                                                                              00000850
C
          GENERATE ELEMENT MATRICES
                                                                              04800000
C
                                                               ..USERO4.
                                                                              60000470
      MLIB. . XLD: TR. , KEL. FTEL, SEL. STEL. . . SC. EM: PD= . .
                                                                              00000880
C
          FORM (1 X 1) UNIT AND ALL X 10 NULL MATRICES
                                                                              00000890
¢
         DETERMINE PRINT FORMAT FOR TYPE OF ELEMENTS USED
                                                                              00000900
Č
                                                                              00000910
                                                                              00000920
      11 = SC. IDENTC.
      13 = 11.NULL.SC
                                                                              60000930
      DEFF # 11 .SMULT. SC(19.14).
                                                                              00000940
                                                                              00000950
C
          ASSEMBLE STAFFNESS MATRIX AND ELEMENT APPLIED LOADS
                                                                              00000360
                                                                              00000970
C
     KELA = EN SASSEN. SC. (10)
FTELA = EN SASSEN SC. (40)
                                                                              00000980
                                                                              000000990
     . LSCALE, LOADS = XLD .DEJOIN, (1,1)
                                                                              00001000
                                                                              00001010
          REDUCE STIFFNESS MATRIX AND PRINT.
                                                                              00001020
                                                                              00001:30
      KO, KNO = KELA . DEJOIN. ( SC(5,1),1)
                                                                              00001040
      <co,stiff * kno.dejoin.( $C(5,1),0)</pre>
                                                                              00001050
                                                                              00001060
      PRINT(FORCE, DISP. . ) STIFF
                                                                              00001070
          MULTIPLY ELEMENT APPLIED LOADS BY LUAD SCALAR
                                                                              00001080
C
      FIELS = FYELA. YULT. LSCALE
                                                                              00001090
C
          THAYSFURM EXTERNAL LOADS TO 0-1-2 ASSEMBLED SYSTEM
                                                                              00001100
      LOADE - TRANULTALOADS
                                                                              00001110
          FORM TOTAL LOAD COLUMNS
                                                                              00001120
C
      TLOAD = FTELS.ADD.LDADO
                                                                              00001130
      TL, TLUADR = TEDAD-DEJOIN-(SC(5,1),1)
                                                                              00001140
                                                                              00001150
CCC
                                                                              00001160
          SOLVE FOR DISPLACEMENTS
          PRESCRIBED DISPLACEMENTS ARE PRESENT
                                                                              00001170
Č
                                                                              00001180
                                                                              00001190
      \langle 1, \times 2 = STIFF.DEJOIN.(SC(6.1).1)
                                                                              00001200
                                                                              00001210
      K11_{2}K12 = K1_{2}DEJDIN_{2}(SC(6,1)_{2})
      PDG = TR.MULT.PD
                                                                              00001220
      PR. 02 = PD3
                                                                              00001230
                        DEJOIN. ( SC(8,1),1)
      43 = K12.MULT.D2
                                                                              00001240
      PI,P2 = TLDAUR.DEJOIN.(SC(6,1),1)
                                                                              00001250
                                                                              00001260
      K4 = Pl.SUBT.K3
      TRIA, X1 = K11, K4 . CHTRIA.
                                                                              00001270
      XIT = X1.TRANSP.
                                                                              0000128G
      X2T = D2.TRANSP.
                                                                              00001290
      TSX.NICLUA.TIX = TSIX
                                                                              00001300
      XOT = X1T.NULL.KCO
                                                                              00001310
      TSIX.VIQUGA.TOX = TX
                                                                              00001320
       KU = XI.TRANSP.
                                                                              00001330
      X = TR.TMULT.XD
                                                                              00001340
                                                         68
           CALCULATE AND PRINT REACTIONS
                                                                              00001350
                                                                              00001360
```

Figure II-0 Statics With Prescribed Displacements - Cholesky Triangularization

	REACTY - KELA-MULT-NO	00001380 00001370
	REACT . REACTT SUBT TLOAD	00001390
C	A APPRECATE THE STATE OF THE PRESENCE	00001400
Č	ELEMENTS HAVE I OR & DEGREES OF PREEDON	00001410
C	TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL TOTAL	00001420
C	PRINT ELEMENT APPLIED LOADS AND EXTERNAL LOADS	00001430
C C C	PRINT ASSEMBLED, DESPLACEMENT COLUMN.	00001440
C	and the state of t	00001450
	IF (DIFF-NULLS) GO TO 10	00001460
	GPRINTIA. FY. FZ. MX. MY. HZ. SC. TR PFTELA	00001470
	GRAINTE 4 FX . FY . FZ . HX . MY . MZ . SC .) LOADS	.00001480
	GPRINT(20 U.V. H. THETAX THE TAY. THETAX SC. 1X	00001490
	GPRINT(1FX.FY.FZ.MX.NY.MZ.SC.TR JREACT	00001500
	EF (13.NULL.) GO TO 60	00001510
C		00001520
C C	ELEMENTS HAVE 3 DEGREES OF FREEDOM	00001530
C		00001540
10	GPRINT(4FR.O.FZ.O.HOETA.O.FI.O.F3.SC.TR)FTELA	00001550
	CONTUTION FROM EXAMPLETA OF LA VAPS 1801	00001550
	cootutto	00001570
	GPRINT(1, FR.O.FZ.O. MBETA. O. F1. O.F3.SC.TR)REACT	00001580
C	. ***	00001590
č	GENERATE STRESSES AND FORCES	03001600
CCC	, and the second se	00001610
ัธว	STRESS = EN, XO .STRESS. (4.)	0001950
35	FORCE = EM-XD .FORCE. (4.)	0001010

Figure II-6 - (Concluded)

(7) Stability Analysis Instruction Sequence (SMABILITY)

Figure II-7 presents the suggested set of abstraction instructions for use in performing elastic instability analyses.

The structural stability analysis is a two-phase process, the first step of which is a linear elastic stress analysis for which the initial stress state is zero. The second phase of the analysis procedure, begins with the formation of element incremental stiffness matrices which are derived from the mid-plane stress resultants determined in the linear stress analysis. After assembly of element incremental stiffness matrices, a linear eigenvalue solution is obtained for the critical buckling load. Using this approach, the assumption is made that all mid-plane forces remain in a fixed ratio to one another at all levels of applied load, from the onset of loading to the achievement of instability. A detailed derivation of the algebraic expressions used for the Stability Analyses is given in Section III of Reference 4.

It is to be noted that in the MAGIC III System, incremental stiffness matrices are provided for the following finite element representations:

- a. Quadrilateral Plate (Ident. No. 28)
- b. Triangular Plate (Ident. No. 27)
- c. Incremental Frame (Ident. No. 13)

The derivations of these elements are presented in detail in Reference 4.

The stability analysis instruction sequence of Reference 5 is presented for comparison purposes in Figure II-8. It is included in this document without change. Detailed matrix operations concerning the use of these operations are presented on pp. 69-80 of Reference 5.

The suggested form of solving the elastic instability analysis, shown in Figure 7, uses the Cholesky triangularization method. Differences in instructions between Figures II-7 and II-8 are as follows:

Statement No. 346 of Figure II-7 has the form:

FLEX, XR = STIFF, TLOADR. CHTRIA.

where

FLEX = The Triangularized Stiffness Matrix

XR = The Reduced Displacement Solution Vector

STIFF = The Reduced Stiffness Matrix

TLOADR = The Reduced Total Applied Load Vector

(Note p. 8 , Section II.B.2 of this report.)

Once the triangularized stiffness matrix, FLEX, has been determined, and after the assembly of the element incremental stiffness matrices, INCR, Statement 386 is utilized as follows:

EIG = FLEX.CHOL.INCR

where EIG = The solution of the back substitution system.

Statement Number 386 of Figure II-7 is equivalent to:

EIG = FLEX.MULT.INCR which is Statement Number 239 of Figure II-8.

The use of the instructions as outlined in Figure II-7 avoids the inversion of the stiffness matrix which for large order systems may prove inefficient and computationally prohibitive.

```
SSTABILITY
                                                                             00003110
                                                                             J0003120
   --- STABILITY AGENDUM ANALYSIS
                                                                             00003130
c.
                                                                             00003140
C
Ċ
         STABILITY ANALYSIS INSTRUCTION SEQUENCE
                                                                             00003150
                                                                             00003163
Č
         GENERATE ELEMENT MATRICES
                                                                             00003170
¢
                                                                             00003180
      , MLIO, INTPIXED .TR. , KEL, FTEL, SEL, STEL, .. SC .E M. = ...
                                                                 .. USERO4.
                                                                             00003190
¢
                                                                             00003200
C
         FORM (1 X 1) UNIT AND (1 X 1) NULL MATRICES
                                                                             00003210
         CETERMINE PRINT FORMAT FOR TYPE OF ELEMENTS USED
                                                                             03033223
¢
                                                                             00003230
      II = SC. IDENTC.
                                                                             00003249
                                                                             00003250
      13 = 11. NULL .SC
      DIFF = II .SHULT. SC(9.1)
                                                                             00003265
                                                                             00003270
C
         ASSEMBLE STIFFNESS MATRIX AND ELEMENT APPLIED LOADS
                                                                             00003280
C
                                                                             00003293
      STIFF= EN .ASSEM. SC.(1)
                                                                             00003300
      FTELA = EM .ASSEM .SC, (40)
                                                                             00003310
      LSCALE, LOADS = XLD . DEJO IN . (1, 1)
                                                                             00003323
      PRINT( FORCE, DISP. . ) STIFF
                                                                             00003333
                                                                             00003340
         MULTEPLY ELEMENT APPLIED LOADS BY LOAD SCALAR
C
                                                                             00003350
      FTELS = FTELA. NULT. L SCALE
                                                                             20003362
C
         TRANSFORM EXTERNAL LOADS TO 0-1-2 ASSEMBLED SYSTEM
                                                                             00003370
                                                                             00003380
      LCACG = TR.MULT.LBADS
C
         FORF TOTAL LOAD COLUMNS
                                                                             00003392
                                                                             00003400
      TLGAD = FTELS.ADD.LJADO
         FCRM REDUCED TOTAL LOAD COLUMN
                                                                             00003413
C
      TL.TLDADR = TLOAD.DEJDIN.( SC(5.1).1)
                                                                             00003420
                                                                             00003433
C
         PRINT FLEXIBILITY NATRIX
                                                                             20023442
C
                                                                             00003450
C
      FLEX,XR = STIFF,TLOADR .CHTRIA.
                                                                             90003460
      PRINT (DISP, FORCE, . ) FLEX
                                                                             00003470
                                                                             09003480
C
C
         SOLVE FOR DISPLACEMENTS
                                                                             00003490
                                                                             00003500
      TRO, TR12 = TR. DEJOIN . (SC(5, 1), 1)
                                                                             00003510
      X = TRIZ.THULT.XR
                                                                             00003520
      XC = TR.MULT.X
                                                                             00003530
                                                                             00003540
      IF (DIFF.NULL.) GO TO 10
```

Figure II-7 - Stability Instruction Sequence - Cholesky Triangularization

```
00003550
         PRINT ELEMENT APPLIED LOADS AND EXTERNAL LOADS
                                                                              00003552
CCC
                                                                              00003570
         ELEMENTS HAVE 1 OR 2 DEGREES OF FREEDOM
                                                                              00003582
                                                                              00003590
      GPRINT 14. . . FX . FY . FZ . MK . MY . MZ . SC . TR I FTELA
                                                                             00003600
      GPRINT 14. . . FX. FY. FZ. HX. HY. MZ. SC.
                                                                              00003610
      GPRINT 12. . . U . Y . K. THETAX . THETAY . THETA Z. SC.
                                                                              00003620
      IF (13.NULL.) GO TO 60
                                                                              00003630
                                                                              00003640
C
          ELEMENTS HAVE 3 DEGREES OF FREEDON-
                                                                              00003650
                                                                              00003660
 19
      GPRINT (4. . . FR. O . FZ . O . 4 BETA . O . F3 . SC . TR IFTELA
                                                                              00003670
      GPRINT (4., FR. O.FZ. O. 4 BETA. O.F1. O.F3.SC.
                                                   LOADS
                                                                              00003680
      GPRINT (2., , U.O.W.O.THETAY.O.W.O.W.+, SC,
                                                                              00003692
Ċ
                                                                              00003.700
         GENERATE STRESSES
                                                                              00003710
C
                                                                              00003720
 60
      STRESS = EM. XO .STRESS. (4.)
                                                                              00003730
C
                                                                              00003743
Ċ
         GENERATE ELEMENT INCREMENTAL STIFFNESS MATRIX
                                                                              00003750
C
                                                                             00003763
      .STRESS.USER04.
                                                                              00003770
Ç
                                                                              20023782
C
         ASS EMBLE AND REDUCE INCREMENTAL MATRIX
                                                                              00003790
                                                                             00003800
      INCR = EL .ASSEM. SC.(3)
                                                                              00003813
      PRINT(...) INCR
                                                                              00003820
Ç
                                                                             00003830
         CREATE INPUT EIGENVALUE MATRIX
                                                                             00003840
C
                                                                             09093853
      EIG = FLEX . CHGL. INCR
                                                                             00003860
      PRINT (...) EIG
                                                                              00003870
C
                                                                              00003880
C
         CALCULATE AND PRINT E-VALUES, E-VECTORS, FREQUENCIES
                                                                             00003890
                                                                             00003900
      EVALUE. EVECTR., = EIG. . EIGENL. SC
                                                                             00003910
      GPRINT (3,,,,SC, TR12) EVECTR, EVALUE
                                                                             00003920
```

Figure II-7 - Concluded

######################################	9 SERO4 •	90901630 90001660 90001660 90001670 90001690 90001710 90001720 90001730 90001740 90001750 90001760
C ASSEMBLE STIFFNESS MATRIX AND ELEMENT APPLIED LOADS STIFFE EM .ASSEM. SC.(1) FIELA = EM .ASSEM. SC.(40) LSCALE, LOADS = XLD .DEJOIN.(1,1) PRINT(FORCE.DISP.) STIFF C MULTIPLY ELEMENT APPLIED LOADS BY LOAD SCALAR FIELS = FIELA.MULT.LSCALE TRANSFORM EXTERNAL LOADS TO Q.Z.Z. ASSEMBLED SYSTEM LOADD = TR.NULT.LOADS C FORM TOTAL LOAD COLUMNS TLJAD = FIELS.ADDLOADD C FORM REDUCED TOTAL LOAD COLUMN TL.TLOADR = TLJAD.DEJOIN.(SC(5,1),1) C PRINT FLEXIBILITY MATRIX FLEX = STIFF.INVERS. PRINT (DISP.FORCE,,) FLEX C SJLVE FJR DISPLACEMENTS C XR= FLEX.MULT.XCADR TRO,TRIZ = TR.DEJOIN.(SC(5,1),1) X = TRIZ.THULT.XR XQ = TR.MULT.X IF (DIFF.NULL.) GD TO 10 C PRINT ELEMENT APPLIED LOADS AND EXTERNAL LOADS C ELEMENTS MAVE 1 OR 2 DEGREES OF FREEDOM C GPRINT(4.,,FX.FY.FZ.MX.MY.MZ.SC.,TR.)FTELA GPRINT(4.,,FX.FY.FZ.MX.MY.MZ.SC.,)LOADS GPRINT(2.,,UUV.N.THETAX.THETAY.THETAZ.SC.,) X IF (13.NULL.) GD TO 60 Figure II-8 - Alternate Stability Instruction Sequence Matrix Inversion 74		00001780 00001790 00001810 00001810 00001820 00001830 00001850 00001850 00001850 00001850 00001950 00001930 00001940 00001940 00001950

		araaktia
	ELEMENTS HAVE 3 DEGREES OF FREEDON	00002180
		00002190
10	GPRINTIA,,,FR.O.EZ.O.MRETA.O.FI.O.F3,SC,TR IFTELA	30002200
	GPRINT(4FR.O.FZ.O.MOETA.O.F1.O.F3.SC. JEOADS	00002210
	GPRINT(2,,,U.O.H.O.THETAY)Q.H+.O.H++.SC. Y X	90002220
		00002230
	generate. Stresses	90602240
		00002250
10	STRESS = ENGKO aSTRESS. (4)	90002260
		0000227.0
	GENERATE ELEMENT INCREMENTAL STIFFNESS MATRIX.	00002280
	Abitaining against and tank and the finite times.	00002290
	e e e e e e e e e e e e e e e e e e e	00002300
	the state of the s	00002310
	ASSERBLE AND REDUCE INCREMENTAL MATRIX	00002320
	undergrade unia irraden elimpelistatus junition	00002330
	INCR # EL .ASSEM. SC. (3)	00002340
	PRINT(,,,) INCR	00002350
	C DOUGH & & & & C DERWIN	00002360
		220,00300
	• • • • • • • • • • • • • • • • • • •	
-		
	CREATE INPUT EIGENVALUE MATRIX	00002370
		00002380
	EIG = FLEX.MULT.INCR	00002390
	PRINT (, , ,) EIG .	00002400
		00002410
	CALCULATE AND PRINT E-VALUES, E-VECTORS, FREQUENCIES	00002420
		00002430
	Evalue, evectr, , = eigeigeni. Sc	00002440
	CORINTIAL SC. TRIDI EVECTO SVALUE	00002650

Figure II-8 (Concluded)

(8) Dynamics Analysis Instruction Sequence (DYNAMICS)

Figure II-9 presents the suggested set of abstraction instructions for use in performance of a vibration analysis. This particular set of instructions provides modes and frequencies for a structural system in which the rigid body modes have been suppressed (i.e. the assembled stiffness matrix has been rendered non-singular by the appropriate application of physical boundary conditions. As seen from Figure II-9 the .EIGEN 1. abstraction instruction is used in this sequence. This instruction is based on the "power method" of extracting eigenvalues and eigenvectors. The desired number of modes and frequencies are supplied as input by the User in the Structural Analysis Input Section. This information is contained on a specialized preprinted input data form entitled DYNAM. This form was described in detail in the Structural Input Data Section of Reference 5.

The Dynamics Analysis Instruction Sequence has been written to accommodate non-structural lumped masses to augment the structural mass matrix generated by the MAGIC III System. A specialized preprinted input data form entitled Lumped Masses has been provided for input of the lumped mass values and is displayed in Figure II-16 of Section II.C.5. It is noted that this data form can also be utilized to input lumped structural mass values at the option of the User.

If this were the case, the User would specify a mass density value of zero (0.0) on the Material Tape Input Section data form which is described in detail on pp. 97 - 101 of Reference 5. In addition, output matrix position twelve (OMP 12) of the USER04. instruction. Statement No. 401 of Figure II-9 would be left blank so that the MAGIC III System would not generate element mass matrices (MEL) for the application in question.

Additional output data from this set of instructions include generalized mass and generalized stiffness values for each mode requested.

Table V is provided as a supplement to Figure II-9. This Table provides engineering and matrix definition for each abstraction instruction listed in Figure II-9.

OY	námi CS	00003933
		00003.440
إحدا	e-Dynanics agéndun añalysis.	00003953
•		00003.960
•	dynamics analysis instruction sequence	26Q53975
•	APAIDE SP. PICOLO MARKETANA	00003960
:	GENERATE ELEMENT MATRICES	00003995
•	FHLIBE MILDET RESKELES ER EMÉLESCE EN . RESERVENCEROS.	00004003 00034013
•	t united automate and automate and mile At he secures	00004020
:	ÁSS ÉKÖLE STIFFNESS HATRIX AND HASS ÁA TRIX	00004030
;	•	90004043
	STIFF EN ASSEN. SC. (1)	00004050
	MASSM = EM .ASSEM. SC. (2)	00034063
<u>:</u>	n an haife derick bridge dated Milliands derick bare and an extensive an extensive and an extensive and an extensive and an extensive an extensive and an extensive and an extensive and an extensive analysis and an extensive and an extensive and an extensive and an extensive an extensive and an extensive and an extensive and an	00004075
:	DEFINE LUMP HASS AND TOTAL MASS MATRIX	00004083
•	Merks thire _ man without st to	09004090
	MSCAL, LMASS ∞ MCO .DEJO M. € 1,1) LUMPO ≈ TR. :MULT. LMASS	00004105
	LL, LUMP = LUMPO DEJOIN. (SC(5,1),1)	00004 <u>11</u> 3- 00004120
	DLUMP = LUMP .DIAGON.	00004133
	MASS = MASSM .ADD. DLUMP	00004140
	441 A 35 B B B B B B B B B B B B B B B B B B	00004153
	PRINT STIFFNESS MATRIX AND MASS MATRIX	90004163
	PRINT(PORCE, DISP, , F STIFF	00004170 00004180
	, nam, i kania at at a sk a sk at a	00004190
	Printerorce/Accel, #1 "NASS"	00094203
	•	00004210
	GENERATE DYNAMICS MATRIX	60004350
	KINY, DYNAM = STIFF, RASS .CHTRIA.	00004230
	vrustnius - striklims onutura	00004243 00034253
	FINC E-VALUES, E-VECTORS; NORMAL MODES,	00004263
	FREQUENCIES AND PRINT	60004270
		00004283
	evalue, evect oynamgigeni. sc	00004293
	TRO, TR12 = TR . DEJOIN. (SC(5,1),1)	00004300
	GPRINT (3, SC, TRIZ) EVECT, EVALUE	0000431 3 00004323
	ALLINIS CONTRACTOR SAMON CAMPAC	00004320
	GENERATE STIFFNESS AND GENERALIZED MASS	00004343
	MATRICES AND PRINT	00004350
	The same and the same same and the same same same same same same same sam	00004360
	KGENI = EVECT. THUL A. STIFF	00004373
	KGEN = KGENIHULT.gevect MSENI = EvectThult.ghass	00004383
	HOEN - MOENT MULTIEVECT	00004390 00004400
	PAINT (no.) MOEN, KOEN, KINV, DYNAM	00004413
	र परक्षारम् च स्ति हा र । १९४० क्या व्यवस्था का स्वास्ति व स्वत्य व हा व राज्यवर व	AAAA 4 4 8 8

TABLE V DYNAMICS INSTRUCTION SEQUENCE (STEP BY STEP DESCRIPTION)

STATEMENT	
SEQUENCE NUMBER	INSTRUCTION AND EXPLANATION
401	MLIB, MLD, TR, KEL, , , , MEL, SC, EM, = , , , . USERO4.
	Generates the element stiffness matrices KEL, lumped mass matrix column MLD, and element mass matrices MEL, required for the dynamics problem.
405	STIFF=EM.ASSEM.SC.(1)
e vice and the second	Forms the assembled reduced stiffness matrix, STIFF from the element stiffness matrices stored in EM. SC contains system constants required by the .ASSEM. routine.
406	Massm=Em.assem.sc,(2)
والمتعادية	Forms the assembled reduced mass matrix, MASS from the element mass matrices stored in EM. System information required by .ASSEM. is input in SC.
410	MSCAL, LMASS=MLD. DEJOIN. (1,1) MSCAL LMASS MLD
	The mass scalar, MSCAL and the lumped mass column LMASS are dejoined in the MLD matrix. It is noted that MSCAL is the first row of MLD.
411	LUMPO=TR.MULT.LMASS [LUMPO]*[TR] [LMASS]
	Transforms the unordered total jumped mass column, LMASS, to the 0-1-2 ordered assembled column, LUMPO.
412	IL, LUMP-LUMPO. DEJOIN. (SC(5,1),1) [IL
	Forms the reduced total lumped mass column, LUMP, which reflects l's and 2's.
413	DLUMP=LUMP.DIAGON.
	Diagonalizes the vector, LUMP, to form a square diagonal matrix, DLUMP.

TABLE V (CONTINUÉD)

(CONTINUED)			
STATEMENT SEQUENCE NUMBER	INSTRUCTION AND EXPLANATION		
414	MASS=MASSM.ADD.DLUMP [MASS] = [MASSM] + [DLUMP] Augments the assembled structural mass matrix, MASSM with the additional (non-structural) contribution DLUMP to form the total mass matrix, MASS.		
418	PRINT(FORCE, DISP, ,) STIFF Prints the reduced stiffness matrix.		
420 . ´	PRINT(FORCE, ACCEL,,) MASS Prints the reduced mass matrix.		
42 ¹ 4	KINV, DYNAM=STIFF, MASS.CHTRIA. Solves the following set of equations: [STIFF] [DYNAM] = [MASS] [KINV] = Triangularized stiffness matrix [DYNAM] is the dynamic matrix and is equivalent to the inverse of the stiffness matrix times the mass matrix, i.e., [K]-1 [M].		
429	EVALUE, EVECT, EDYNAM, EIGENI.SC solve [DYNAM] - [EVALUE] [I] [EVECT] = [0] Computes the required eigenvalues and corresponding eigenvectors of the dynamics matrix using the power method. The eigenvalues are stored in the column matrix EVALUE and the corresponding eigenvectors are stored as columns in EVECT. The frequencies and mode shapes are also printed out.		
431	TRO,TR12 = TR.DEJOIN.(SC(5,1),1) TRO TRI2 = [TR] Forms the matrix TR12 which will be used by the .GPRINT. instruction.		
432	.GP NT.(3,,,,SC,TR12)EVECT,EVALUE Prints the eigenvalue column and the eigenvector in engineering format.		

TABLE V (CONTINUED)

Continuing		
STÅTEMENT SEQUENCE NUMBER	INSTRUCTION AND EXPLANATION	
437 .	KGEN1=EVECT.TMULT.STIFF [KGEN1] = [EVECT] [STIFF] Forms the product of the transpose of the eigenvector.	
438	matrix and the reduced stiffness matrix. KGEN≅KĠEN1.MULT.EVECT [KGEN] = [EVEÇT] ^T [STIFF][EVECT]	
` '	Forms the generalized stiffness matrix in KGEN by forming the product of KGEN1 and EVECT.	
439	MGEN1=EVECT.TMULT.MASS [MGEN1] = [EVECT] ^T [MASS] Forms the product of the transpose of the eigenvalue matrix and the reduced mass matrix.	
, 440	MGEN=MGEN1.MULT.EVECT [MGEN] = [EVECT] ^T [MASS] [EVECT] Forms the generalized mass matrix in MGEN by forming the product of MGENI and EVECT.	
441.	PRINT(,,,)MGEN, KGEN, KINV, DYNAM Prints the generalized stiffness matrix, the general- ized mass matrix, the triangularized stiffness matrix and the dynamic matrix.	

(9) Free-Free Dynamics Analysis Instruction Sequence (DYNAMICSF)

Figure II-10 presents the suggested set of abstraction instructions for use in performance of a free-free vibration analysis. This particular set of instructions provides modes and frequencies for a structural system in which the rigid body modes are present. Provision for lumped non-structural mass is provided as well as the provision for lumped structural mass. The values are input, if required, via the lumped mass preprinted input data form shown in Figure II-16. It is noted from the lumped mass form that provision is made to input a mass scalar value. This value is utilized in the performance of a free-free vibration analysis as follows.

Given the equations of motion of a free-free system:

$$[M] \{g\} + [K_f] \{g\} = \{o\}$$

$$(1)$$

where $\left[K_{f}\right]$ is a singular stiffness matrix. The natural frequencies and corresponding mode shapes can be determined from lowest to highest by solution of the following eigenvalue problem.

$$\left[a, [M] + [K_f]\right]^{-1} [M] \left\{\phi_i\right\} = \lambda_i \left\{\phi_i\right\}$$
 (2)

from which the natural frequencies may be recovered as follows:

$$f_{n_{\underline{1}}} = \frac{1}{2\pi} \sqrt{\left(\frac{1}{\lambda_{\underline{1}}}\right) - \mathcal{Q}_{\bullet}}$$
 (3)

where Q_{\bullet} is the mass scalar value input on the lumped mass input data form. Detailed discussion of the above procedure can be found in References 12 and 13.

It is noted that when the above technique is utilized, caution must be exercised in choosing the value of the scalar \mathcal{Q}_{\bullet} . Problems arise in some cases when diagonal mass matrices are employed whose terms are on the order of 10^{-2} compared to terms on

```
SOYNAMICSE
                                                                            20034422
                                                                            09004430
                                                                            00004440
      -DYNAMICS (FREE-FREE) AGENDUM ANALYSIS.
                                                                            00004450
C
        DYNAMICS ANALYSIS INSTRUCTION SEQUENCE
                                                                            00004460
C
        GENERATE ELEMENT MATRICES
                                                                            00004470
      , MLTB, M. TR., KEL, ... MEL, SC. EH, - ... . ISERO4.
                                                                            00004483
C
                                                                            00004490
      ASSEMBLE STIFFNESS AND CONSISTENT MASS MATRICES
                                                                            00004503
C
                                                                            00004510
      STIFF = EN .4 SSEM. SC. (1)
                                                                            00004520
      MASSM = EN .ASSEM& SC. (2)
                                                                           00004530
C
      DEFINE LUMP HASS
                                                                           02024542
      MSCAL, EMASS = M .DEJOIN. (1.1)
                                                                            00004550
      LUMPO = TR .MULT. LHASS
                                                                           00004560
      LL, LUMP # LUMPO .DEJOIN. ( SC (5,11,11
                                                                           00004570
      DLUMP . LUMP .DIAGON.
                                                                           00004580
C
                                                                           00004590
C
      DEFINE TOTAL MASS MATRIX
                                                                           0004600
      MASS # MASSM .ADD. DLUMP
                                                                           00004610
      MASSI = MASS .SHULT. MSCAL(1,1)
                                                                           09004620
C
                                                                           00004630
      PRINT STIFFNESS AND MASS MATRICES
C
                                                                           00004640
      PRINT (FORCE, DISP.,) STIFF
                                                                           00004650
      PRINT ( FORCE, ACCEL, ) MASS
                                                                           00004660
C
                                                                           00004670
      COMPUTE DYNAMIC MATRIX
¢
                                                                           00004683
C
                                                                           00004690
      STIFFH = MASSI .ADD. STIFF
                                                                           20004702
      FLEX, DYNAM . STIFFM, HASS .CHTRIA.
                                                                           00004713
C
                                                                           90094729
C
      GENERATE E-VALUES AND FREQUENCIES AND PRINT
                                                                           00004730
C
                                                                           00004740
      EVALUE, EVECT, . DYNAM, .EIGEN1. SC
                                                                           00004750
      TRO, TR 12 = TR .DEJOIN. (SC(5,11,1)
                                                                           00004763
      GPRINT ( 3,,,, SC, TR12) EVECT, EVALUE
                                                                           00004770
C
                                                                           00004780
C
      GENERATE GENERALIZED STIFF AND MASS . PRINT
                                                                           00004790
                                                                           00004800
      KGEN1 = EVECT .TMULT. STIFF
                                                                           00004830
     KGEN " KGEN1 .MULT. EVECT.
MGEN1 " EVECT .THULT. MASS
                                                                           70004820
                                                                           00004830
      MGEN = MGEN. . MULT. EVECT
                                                                           00004842
     PRINT (...) MGEN, KGEN, FLEX, DYNAM
                                                                           00004850
```

the order of 10^6 in the stiffness matrix. This requires the analyst to adjust the value of \mathcal{Q}_{\bullet} , so that the matrix product \mathcal{Q}_{\bullet} [M] when added to the stiffness matrix will render it non-singular. A large value of \mathcal{Q}_{\bullet} can cause problems when the elastic frequencies of interest are low (say below 10 to 15 cps) since the frequencies being calculated are a function of:

$$\sqrt{\left(\frac{1}{\lambda_1}\right) - a_o}$$

It has been found, in general, that when consistent mass matrices are employed in the vibration analysis, a value of $Q_0 = 1.0$ will usually suffice as the scalar value of the mass matrix multiplier.

Table VI is provided as a supplement to Figure II-10. This Table provides engineering and matrix definition for each abstraction instruction listed in Figure II-10.

TABLE VI FREE-FREE DYNAMICS INSTRUCTION SEQUENCE (STEP BY STEP DESCRIPTION)

	(pint of other proportition)
STATEMENT SEQUENCE NUMBER	INSTRUCTION AND EXPLANATION
448	, MLIB, ,M, TR, ,KEL, , , , ,MEL,SC, EM, =, , , . USÉRO4.
	Generates the element stiffness matrices, KEL, lumped mass matrix column, M and element mass matrices MEL, required for the dynamics problem.
452	STIFF=EM.ASSEM.SC,(1)
	Forms the assembled reduced stiffness matrix, STIFF from the element stiffness matrices stored in EM. SC contains system constants required by the .ASSEM. routine.
453	Massm=Em.assem.sc,(2)
	Forms the assembled reduced mass matrix, MASS from the element mass matrices stored in EM. System information required by .ASSEM. is input in SC.
455	MSCAL, LMASS=M. DEJOIN.(1,1) [MSCAL] = [M] The mass scalar, MSCAL and the lumped mass column LMASS are dejoined in the M matrix. It is noted that MSCAL is the first row of M.
456	LUMPO = TR.MULT.LMASS [LUMPO] = [TR][LMASS] Transforms the unordered total lumped mass column, LMASS, to the 0-1-2 ordered assembled column, LUMPO.
457	LL,LUMP=LUMPO.DEJOIN.(SC(5,1),1) \[\begin{aligned} \text{LL} - \\ \text{LUMPO} \end{aligned} = \begin{aligned} \text{LUMPO} \\ \text{Forms the reduced total lumped mass column, LUMP, which reflects 1's and 2's.} \end{aligned}

TABLE VI (CONTINUED)

	(contingro)
STATEMENT SEQUENCE NUMBER	instruction and explanation
458	DLUMP=LUMP.DIAGON.
	Diagonalizes the vector, LUMP, to form a square diagonal matrix, DLUMP.
461	mass=massm.add.dlump [mass] = [massm] + [dlump]
	Augments the assembled structural mass matrix, MASSM, with the additional (non-structural) contribution DLUMP to form the total mass matrix, MASS.
462	massi=mass.smult.mscal(1,1) [massi] = mscal [mass]
,	Performs the scalar multiplication of MSCAL times MASS. This is equivalent to Q. [M]detailed in the writeup.
465	PRINT(FORCE, DISP,,) STIFF
	Prints the reduced stiffness matrix.
466	PRINT(FORCE, ACCEL,,) MASS
	Prints the reduced mass matrix.
470	STIFFN-MASS1.ADD.STIFF
	STIFFM = [MASS1] + [STIFF]
	Adds [MASS1] to STIFF to form STIFFM, This is equivalent to [2, [M] + [K]] as described in the writeup.
471	flex, dynam=stiffm, mass. Chtria.
	Solves the following set of equations [STIFFM] [DYNAM] = [MASS] [FLEX] = Triangularized Stiffness Matrix [DYNAM] is the dynamic matrix and is equivalent to the inverse of the stiffness matrix times the mass matrix, i.e., [K] -1 [M].

TABLE VI (CONTINUED)

All residents and the second	(CONTINUED)
Statement Sequence Number	INSTRUCTION AND EXPLANATION
47.5	EVALUE, EVECT, .=DYNAM, .EIGEN1.SC solve [DYNAM] - [EVALUE][I] [EVECT] = [0] Computes the required eigenvalues and corres- ponding eigenvectors of the dynamics matrix using the power method. The eigenvalues are stored in the column matrix EVALUE and the corresponding eigenvectors are stored as columns in EVECT. The frequencies and mode shapes are also printed out.
476	TRO, TR12=TR.DEJOIN. (SC(5,1),1) TRO TRI2 = [TR] Forms the matrix TR12 which is used by the .GPRINT. instruction.
477	.GPRINT.(3,,,,SC,TR12)EVECT,EVALUE Prints the eigenvalue column and the eigenvector matrix in engineering format.
481	KGEN1=EVECT.TMULT.STIFF [KGEN1] = [EVECT] ^T [STIFF] Forms the product of the transpose of the eigen- vector matrix and the reduced stiffness matrix.
482	KGEN-KGEN1.MULT.EVECT [KGEN] = [EVECT] ^T [STIFF][EVECT] Forms the generalized stiffness matrix in KGEN by forming the product of KGEN1 and EVECT.
483	MGEN1=EVECT.TMULT.MASS [MGEN1] = [EVECT] ^T [MASS] Forms the product of the transpose of the eigen- value matrix and the reduced mass matrix.
484	MGEN=MGEN1.MULT.EVECT [MGEN] = [EVECT] ^T [MASS] [EVECT] Forms the generalized mass matrix in MGEN by forming the product of MGEN1 and EVECT.

TABLE VÍ (CONTINUED)

STATEMENT SEQUENCE NUMBER	INSTRUCTION AND EXPLANATION
485	PRINT(,,,)MGEN, KGEN, FLEX, DYNAM Prints the generalized stiffness matrix, the generalized mass matrix, the triangularized stiffness matrix, and the dynamic matrix.

(10) Dynamics Analysis Instruction Sequence With Condensation (DYNAMICSC)

Figure II-11 presents the suggested set of abstraction instructions for use in performance of a vibration analysis utilizing condensation. The condensation technique used is that of Guyan (Reference 11).

The use of this technique allows degrees of freedom considered to be superfluous to be eliminated through the use of a condensation transformation. The technique is analogous to that of Statics with Condensation (STATICSC) with the additional step of applying the condensation transformation to the mass matrix as well as the stiffness matrix. This technique yields an eigenvalue problem which is much reduced in size.

As with the standard dynamics agendum of Figure II-9 (DYNAMICS), lumped structural and non-structural masses are accommodated. The specialized preprinted input data form entitled Lumped Masses (Figure II-16) is utilized, if required.

Degrees of freedom that are considered superfluous and are to be condensed (eliminated) in a particular analysis are designated by the number '2' in the Boundary Condition Section which was discussed in detail on pp. 129-133 of Reference 5.

A detailed algebraic statement of the condensation procedure which is performed using the instructions of Figure II-ll is given on pp. 87-89 of Reference 5.

	-
DYNAMECSC	ეტებ486ე
	00034873
CYNAMICS AGENOUM, HITH CONDENSATION	00004880
3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3	00004890
DYNAMICS AGENDUM ANALYSIS.	00,004,400
	0000491 0
DYNAMICS ANALYSIS INSTRUCTION SEQUENCE	90004920
	00004930
GENERATE EL EHENT MATRICES	00004940.
	02004953
, MLIB, MLD, TR. KEL, p MEL, SC, EM, USER 04.	00004960
1. 2. 2. 2. 2. 2. 2. 2. 2. 2. 2. 2. 2. 2.	00004970
ASSEMBLE STEFFNESS MATRIX AND MASS MATRIX	00,004,980
	00004990
STIFF = EM .ASSEM. SC([1])	00005000
MASSN . EM .ASSEN. SC. (2)	00005619
Magati a fit amagine advica.	00005020
DEFINE LUMP MASS AND TOTAL MASS MATRIX	00005030
DEFINE COM TIMES 1815 TO THE TOTAL THE STATE OF THE STATE	00005040
MSCAL, LMASS = MLD .DEJO No. (1,1)	00005050
LUPPO = TR .MULT. LMASS	00005060
LL, LUMP = LUMPO DEJOIN. (SC(5,1),1)	00005070
DLUMP = LUMP .DIAGON.	00005080
MASS = MASSH .ADD. DLUMP	00005090
LA32 - Hoggy andne pragge	00005100
PRINT STIFFNESS MATRIX AND MASS MATRIX	00035113
PRINT(FORCE, DISP.,) STIFF	00005120
Lutus Laughatanta	00005130
PRINT (FORCE, ACCEL, ,) HASS	20005143
Luzili filluguri ugorras s	00005150
GENERATE DYNAMICS MATRIX	00005160
GENERAL E WILLIAM TO THE STATE OF THE STATE	00005170
TCR.BOT * STIFF .DEJOIN. (SC(6,1),1)	20025182
K11,K12 - TOP .DEJ3IN . (SC(6,1),0)	00005190
K12T,K22 = BOT. DEJO IN. (SG('6,1),0)	00005200
K221,KR1 = K22,K12T .CHTRIA.	20025212
KR2 = K12 .HULTKRI	00005220
KR = K12 .ADD. KR2	00005230
IDENT = K11 IDENTR.	20005242
KRIT = -KRI -TRANSP-	00005250
GAMT - IDENT .ACJOIN. KRIT	00005260
GAM = GAMT .TRANSP.	00005273
MR1 = GAMT .MULT. MASS	00005280
MR = MR1 .MULT. GAM	00005290
KRI DY RAM = KR, MR .CHTRIA.	20025393
Puttnium - Fullu orningue	00005313
	00007328

Figure II-11 - Dynamics Analysis Instruction Sequence with Condensation

FIND É-VALUES, E-VECTORS, NORMAL MODES,	39035323
FREQUENCIES AND PRINT	00005530
	00005340
evalue, evect, . = Dynaq, .cigeni. Sc	30035353
	00005360
TROI, TRE = TR DEJOIN. (SC(8,1),1)	00005370
TRO, TRI - TROI DEJOIN (SC(5, E), 1)	00005380
GPRINT (13 SC. TRI) EVECT, EVALUE	00005390
ALLES TO A A A A A A A A A A A A A A A A A A	00005400
GENERATE STIFFNESS AND GENERALIZED MASS	00005410
HATRICES AND PRINT	00005423
THE TRACES MADITALES	00005430
WATER MARKET PACE & MA	
KGEN1 = EVECT&THULT.KR	30005440
KGEN = KGEN1.MULT.EVECT	50005452
MGEN1 = EVECT.THULT.MR	00005460
MGEN * MGENI.MULT.EVECT	00005470
· ,	00005480
PRINT() MGEN. KGEN. DYNAM, KR. MR	00005490
A COUNTY AND A COMMUNICATION AND A COUNTY AN	*****

Figure II-11 -(Concluded)

(11) Free-Free Dynamics Analysis Instruction Sequence with Condensation (DYNAMICSCF)

straction instructions for use in performance of a free-free vibration analysis with condensation. This particular set of instructions provides modes and frequencies for a structural system in which the rigid body modes are present and for which the technique of condensation is employed. Provision for lumped non-structural mass is provided as well as the provision for lumped structural mass. The Mass Scalar value, Q_{\bullet} , described in the Free-Free Dynamics Analysis Instruction Sequence previously is available to this set of instructions and is used in exactly the same manner as in DYNAMICSF.

Degrees-of-freedom that are considered superfluous and are to be condensed (eliminated) in a particular analysis are designated by the number '2' in the Boundary Condition Section which was discussed in detail on pp. 129-133 of Reference 5. It is noted that User judgement is required in deciding which degrees-of-freedom in a particular analysis are superfluous and which are essential. An objective approach to this decision making process is presented in Reference 14.

The procedure utilized in Figure II-12 is very similar to that employed in dynamic substructuring. A detailed algebraic statement of the dynamic substructuring process is given on pp. 146-165 of Reference 4.

NAMI CS CF	1985 of C. 6 s
nant CSC7	<u> </u>
market ook andersom is by a market of the	00005510
CYNAMICS AGENDUM, WITH CONDENSATION	00005520
ALLA KAROP APPLICATA ALLA CUP TO	00005533
DYNAMICS AGENOUM ANALYSIS	00005540
	00005555
DYNAMICS ANALYSIS INSTRUCTION SEQUENCE	00005563
Berger and the control of the contro	09095575
génerate elekent katricés.	3Q`Q 35 ,583
	40005593
9 MLIBO NO TREE KELEOPERELOSCIENO USER 04.	00005600
	00035613
ASSEMBLE STEFFNESS AND CONSISTENT MASS MATRICES	20005620
	90095630
SŘÍFE 🛎 ENG ASSEN, SCG C17.	90005640
Massy = em. assem. sc.(2)	00005655
DEFINE LUMP MASS	00005665
MSCAL, LMASS = N. DEJO'M.(1:1)	00005675
LUMPO " TR .MULT. LMASS	00005680
el, lurra lurro . dejoin. (SC(5, 1), 1)	00005690
DLUMP - LUMP -DIAGON.	20005700
	00035710
DÉFÈNE TOTAL MASS MATRIX	00005720
MASS = MASSM .ADD. OLUMP	00005,730
March Andre with min	00035740
PRINT STIFFNESS MATRIX AND MASS MATRIX	00005750
PRINT (FORCE, DISP.,) STIFF	90005760
(Saller & spinger and the Commercial Commer	00005770
PRINTEFORCE, ACCEL, . D. MASS	03035.783
itsus a solucionario e uman.	00005790
GENERATE DYNAMICS HATRIX	00005800
AEGENIS ALMANIOS MAINIV	00005810
PAG BOT _ PP EP BEIGIN FRALE IL IL	
TCP.BOT = STAFF .DEJOIN. (SC(6,1).1)	00005823
K11.K12 = TOP .DEJJIN . (SC(6, 8).0)	00005830
K127, K22 = 907, DEJO IN. (SC(6, 1), 0)	00005840
K221,KR1 = K22,K12T .CHTRIA.	00005850
kaz = kiz .Multkri	00005860
KR = K11 -ADD- KR2	00005870
IDENT * KII .IDENTR.	00005880
KRIT = -KRI -TRANSP.	00005890
gant * Ident . Acidin. Krit	00005900

Figure II-12 - Free-Free Dynamics Analysis Instruction Sequence with Condensation

GAP & CAMT .TRANSP.	30005913
MRI = CANT .MUET. MASS	9005920
HR = MRI .MULT. GAM	57935933
MŘ = MŘíSMULT. MŠCAL(Î,1)	00005940
K# # MM . ADD. KR	00005950
KRI,SYAAH = KM,MR .GHTRIA.	20035963
•	20025972
FINC E-VALUES, E-VECTOR'S, NORMAL HODES,	กาดอธิจหวั
FREQUENCIES AND PRINT	J0005992
	00036000
FVALUE-EVECT = DYNAMEIGEN1. SC	00736913
*	00036925
TPO1, TR2 = TR .DEJJIN. (SC(8,1),1)	ดับกซล็ง <u>ลิว</u>
TRO TR1 = TRO1 . DEJO IN. (SC(5, 1), 1):	00005043
GPRINT (3,,,SC,TRL) EVECT, EVALUE	20036053
	ນນີ້ກຸ່ວີຄວ້ອງ
GENERATE STIFFNESS AND GENERALIZED MASS	00036070
MATRICES AND PRINT	20025082
Santragan Mark Control	J0006090
KGENI = EVECT.THULT.KR	70036103
KGEN * KGENI HULT EVECT	30036113
MGEN1 = EVECT.TMULT.HR	J0036123
MGEN = MGENI . MULT . EVECT	00000120
Marii izerii atiarii affa ha i	00006140
PPINT() MGEN, KGEN, DYNAM, KR, MR	
L. Fist 2 & & & S. DOPISE OF DATE OF USE WAS AUT	JJ006150

Figure II-12 - (Concluded)

d. Agendum Level Abstraction Instructions

The Agendum level abstraction capability incorporated into the MAGIC III System has been retained and expanded in the MAGIC III System. The abstraction instructions for specified analyses will be automatically generated for the User when he specifies the corresponding option on the \$INSTRUCTION card. The Agendum library is expandable and the addition of more abstraction instruction sequences (Agendum) only requires the updating of subroutine AGENDM, and of course the Agendum library itself. The use of an Agendum in no way restricts the User because he can include in his input deck his own abstractions to be merged with the selected agendum.

Subroutine AGENDM controls the selection from the Agendum library of the abstraction instruction sequence requested on the \$INSTRUCTION card. At present, this subroutine has the capability to select the following Agendums.

• •		
ì.	STATICSASYM	(Linear Elastic Displacement and Stress Analysis, Triangular Ring -Asymmetric Loading)
2.	STATICS	(Linear Elastic Displacement and Stress Analysis)
3.	STATICSC	(Linear Elastic Displacement and Stress Analysis With Condensation)
4.	STATICS2	(Linear Elastic Displacement and Stress Analysis With Prescribed Displacements)
5.	STABILITY	(Linear Elastic Instability Analysis Using Cholesky Triangularization)
6.	STABILITYA	(Linear Elastic Instability Analysis Using Matrix Inversion)
7.	DYNAMICS	(Vibration Frequencies, Mode Shapes, Generalized Mass and Stiffness for Supported Structures)

8. DYNAMICSF

(Free-Free Vibration Frequencies, Mode Shapes, Generalized Mass and Generalized

Stiffness for Unsupported Structures)

9. DYNAMICSC

(Vibration Frequencies, Mode Shapes, Generalized Mass and Generalized Stiffness with Condensation for

Supported Structures)

10. DYNAMICS CF

(Free-Free Vibration Frequencies, Mode Shapes, Generalized Mass and Generalized Stiffness with Condensation for Unsupported Structures)

The present AGENDUM Library is designed to be updated as new Agendums become available. The programming procedure utilized to add additional options to the library is discussed in Appendix IX of Reference 8.

It is emphasized that the User is not restricted to the use of the above Agendums. They are included as a convenience feature to automatically generate the required instructions for a given standard analysis.

An example of non-agendum usage is as follows

CC

1 7

16

\$MAGIC

\$RUN

ĠQ

\$INSTRUCTION

SOURCE

User Input Abstraction Instructions SPECIAL

Report From Input Deck for .USER04. Instruction \$ \$END

C. STRUCTURAL INPUT DATĀ

1. General Description

Significant pertions of the labor and computer costs of structural analysis are occasioned by incomplete or improper specification of structural input data. In recognition of this, a number of features have been incorporated into the MAGIC System to assist in the confirmation of problem data prior to execution. The most important of these are the prelabeled input data forms which are an integral part of the MAGIC System.

All features which were incorporated into MAGIC I and II are retained and expanded in MAGIC III. Additional prelabeled input data forms have been added to MAGIC III to support the expanded capability of the System. These input data forms contain a number of special features, e.g.,

- (1) "MODAL" Options are provided which preset a table to a given set of values. This MODAL option may be used where indicated.
- (2) "REPEAT" Options are provided which minimize the input data specified by the User. This REPEAT option may be used where indicated.
- (3) The User exercises control options simply by placing an 'X' in a given location on a prelabeled input data form.
- (4) The prelabeled input data forms have permanent label cards which automatically precede subsets of data thereby allowing flexibility in the arrangement of input decks.
- (5) Zeros must be indicated where pertinent. Blanks are never zeros except where specifically indicated.
- (6) Only prelabeled input forms associated with options that are exercised in any particular problem are needed. Data associated with options not exercised are simply omitted.

Prelabeled input data forms new to the MAGIC III System are as follows:

- (1) Element Temperature Input Section
- (2) Element Pressure Input Section
- (3) Element Pre-Strain and Pre-Stress Input Section
- (4) Lumped Mass and Free-Free Input Data Section

Additional prelabeled input data forms peculiar to the triangular ring element which accommodates asymmetric loading have also been added to MAGIC III. These data forms will be described in detail in the Element Input Section which appears later in this document.

The numerical input pertinent to the above data is presented in floating point and fixed point notations. In floating point notation, the decimal point is always shown on the input data and in fixed point notation the decimal is never shown. The floating point notation is applicable, for example, to measurable quantities such as loads, coordinates, etc. The fixed point notation is limited to whole numbers or integers such as grid point numbers.

In floating point notation, a number may be written in either the conventional manner or an a factor of 10^{11} ; for example, the number 30 000 000 = 30 x 10^{6} can be written as either 30 000 000 or 30.0 E6. For numerical input data (both fixed and floating point) plus signs are not normally used. Negative numbers and negative exponents, however, must be preceded by a minus sign.

It is to be noted that the relabeled input data forms discussed in this section are to be used in conjunction (when necessary) with the existing MAGIC System prelabeled data forms. The description for proper usage of existing forms is delineated in detail on pp. 93 - 213 of Reference 5.

The procedure used in the preparation of the additional prelabeled data forms will now be explained in detail. It is important to note that slashes (/) which appear on the prelabeled input data forms, instruct the Keypunch Operator to proceed to the next entry position on the input data form, or if all entries have been punched, to the next data section.

2. Element Temperature Input Section (Figure II-13)

Loading which arises from elevated temperature is considered as element applied loading and is transformed into consistent energy equivalent grid point loads according to element type. For convenience to the User, temperature values (or temperature gradients) can either be input at each grid point, or as element related data.

To provide for grid point temperature input, the Grid Point Temperature labeled data form was provided in the MAGIC II System and is detailed on pp. 114-117 of Reference 5.

An additional option is provided in MAGIC III for element related temperature data. In this section, the User may employ two time saving devices:

- (1) MODAL The MODAL option automates the specification of recurring values within a subset of input data. This feature enables data-prescribed initialization of tables. Explicit data requirements are thereby limited to the specification of exceptions to the MODAL initialization.
- (2) REPEAT A REPEAT option is available which allows the User to retain data from a previous point for the indicated point.

The prelabeled input data form provided for the Element Temperature Input Section is shown in Figure II-13 The first entry on the form is prelabeled ELTEMP and requires no information from the Waer.

The second entry on the form is the MODAL entry which allows the User to input element temperature data which the System assumes to apply to every element unless otherwise indicated in the Element Number Entries which follow the MODAL entry. MODAL is pre-labeled in Columns 1 through 5. Columns 6 through 12 are left blank. The number of temperatures to be entered as MODAL values is entered as

a right justified fixed point number in Columns 13 and 14. The next sixty columns of this card (Columns 15 through 74) and the same sixty columns of the next card combine to form twelve ten column fields. Up to twelve temperatures per element may be entered as MODAL values. If six or less temperatures are entered, only one card is used for the MODAL values. The number and sequence of temperatures which are entered in these locations are functions of the type of element being employed in the analysis. This input is element related and will be explained in detail for each element in the sections which delineate the element descriptions.

The third and following entries in the section contain information pertaining to the Element Numbers, Repeat Option, Number of Temperatures, and Element Temperature Input, e.g.,

Element Number - (Col. 7 - 11)

- (1) Element numbers are entered as fixed point numbers.
- (2) Element numbers <u>must</u> be entered consistent with the order in which they were entered in the Element Control Data Section.

Repeat - (Col. 12)

The repeat option provides the User with the opportunity to repeat Temperature Input from element to element. This is accomplished in the following manner. If the Temperature Input for a number of elements is identical, the User enters the element number and associated input for the first element. For the following elements having the same input, only the Element Number (Col. 7 - 11) and an 'X' in the Repeat column need be entered. If the Repeat option is used, do not make any further entires on this card. (Be sure to leave Cols. 13 and 14 blank.)

Number of Temperatures (Cols. 13 - 14)

The number of temperatures to be entered for the element is entered as a fixed point number in Cols. 13 and 14. This field must be left blank for subsequent entries if they are being repeated from previous entries.

Temperatures (Cols. 15 - 72)

Up to twelve temperatures are entered in fields of ten starting in Column 15 and continuing to 74 for the first six, and again in Cols. 15 through 74 of a second card if necessary. The number of temperatures needed depends upon the element being described. This information is delineated in detail in the section on Element Descriptions.

REMEMBER:

- (1) For a problem with identical input for every element only the MODAL entry is required.
- (2) The repeat option can be used effectively for sets of elements that have the same input. However, element numbers <u>must</u> be entered consistent with the order in which they were entered in the Element Control Data Section.
- (3) If the repeat option is used, leave the field for the number of temperatures blank (Cols. 13 and 14) for subsequent entries if they are being repeated from previous entries.
- (4) If six or less temperatues are entered, only one card is used for that particular element number. Do not git in an extra blank card.
- (5) The type of temperature input required for an element is a function of element type.

			SS			5	2	S	(3)	(})	?		13	2	3	(1)	27	3
		-VL		-	4													
		£ -			*									-				
					~													
	Į	~0			10								- 11				3	
		•			*				-					·	Ţ,			
		2, L			7.8	 	<u> </u>		<u> </u>		-					-		
뾡	l	46			*		Ý			<u> </u>	****							
FŞ		- \$			1010													
Y Y K	,					<u></u>			~~~		<u> </u>				-			
TEKEN PERA MPUT		7			~		200				Ý							
ELEKENT TEMPERATURE MPGT		46	_		-	-	-			13							-	
#			_			-	-	إسب	,				~~			-		
		₩			68				· ·									
	H	,	-1		29				50	-		, j.,		-		-		
	15	15.4	N 22		พพ			·			э Э х							
	IMPUT				.*												<u> </u>	
3	1 1	2 3			23	 -			-					_				-
E	1	-E			30 O													
5	5	No.			80 G	ļ	-			<u> </u>								 -
60	3				*													
3 ≥	- E	~E																
53	Ī	3.	_		\$ \$	-		_					,			-		
₹₹	TEMPERATURE	- \$			4													
MAGIC STRUCTURAL ANALYSIS SYSTEM INPUT DATA FORMAT	۲	23			2			-										
- 7.∢	1					<u> </u>	-	-			-							-
45	ELEMENT	40			40				П									
ã۶	=		_			├										-		
£ -	1			1	~		-											
35	W	5.6			200													\Box
€ 2					- 2	-								-	-			
<u>~</u>		m			23													
오		7				<u> </u>			_					_				
ğ		mo-			~ ~													
₹		* <u>_</u>							·									
_		2				-				-			-		-	-	-	-
					67												•	
		2470			27.22								I	l				
		7			34				 								$\vdash \vdash$	-
		~			~													
		0 3			20			 						 		<u> </u>		
					6													
		•	Ę															
,		7			1 567			<u> </u>										
	<u>L</u>	0			~ 15	二												
sesulbiaem	.1	-6			23.4	-			***		****			 			₩₩	-
<u> </u>				190007	~				***				***				****	
			l		-5				***		***		₩	<u> </u>			***	
				Element Number	-3						***							
S				3.3	7 8													
لينتسا						L	****		****		****		****	L	****	<u> </u>	*****	لــــا
3 4	•	*	901															
ğ F		~[웃															
A C		~	싉						. ~									
~ليا ه	•	~!_	لتت					10)2									

Figure II-13 - Element Temperature Input Data Form

3. Element Pressure Input Section (Figure II-14)

Loading which arises from distributed pressure is considered as element applied loading and is transformed into consistent energy equivalent grid point loads according to element type. For convenience to the User, pressure values can either be input at each grid point, or as element related data.

To provide for grid point pressure input, the Grid Point Pressure labeled data form was provided in the MAGIC II System and is detailed on pp. 110-113 of Reference 5.

An additional option is provided in MAGIC III for element related pressure data. In this section, the User may employ the same two time saving devices as previously described in the Element Temperature Section, e.g., The MODAL and Repeat Options.

The prelabeled input data form provided for the Element Pressure Input Section is shown in Figure II-14. The first entry on the form is prelabeled ELPRESS and requires no information from the User.

The second entry on the form is the MODAL entry which allows the User to input element pressure data which the System assumes to apply to every element unless otherwise indicated in the Element Number Entries which follow the MODAL entry. MODAL is pre-labeled in Cols. 1 through 5. Columns 6 through 12 are left blank. The number of pressures to be entered as MODAL values is entered as a right justified fixed point number in Columns 13 and 14. The next sixty columns of this card (Cols. 15 through 74) and the same sixty columns of the next card combine to form twelve ten column fields. Up to twelve pressures may be entered as MODAL values. If six or less pressures are entered, only one card is used for the MODAL values. The number and sequence of pressures which are entered in these locations are functions of the type of element being employed in the analysis. This input is element related and will be explained in detail for each element in the sections which delineate the element descriptions.

The third and following entries in the section contain information pertaining to the Element Numbers, Repeat Option, Number of Pressures, and Element Pressure Input, e.g.,

Element Number - (Col. 7 - 11)

- (1) Element numbers are entered as fixed point numbers.
- (2) Element numbers <u>must</u> be entered consistent with the order in which they were entered in the Element Control Data Section.

Repeat - (Col. 12)

The repeat option provides the User with the opportunity to repeat Pressure Input from element to element. This is accomplished in the following manner. If the Pressure Input for a number of elements is identical, the User enters the element number and associated input for the first element. For the following elements having the same input, only the Element Number (Col. 7 - 11) and an 'X' in the Repeat column need be entered. If the Repeat option is used, do not make any further entries on this card. (Be sure to leave Cols. 13 and 14 blank.)

Number of Pressures - (Col. 13 - 14)

The number of pressures to be entered for the element is entered as a fixed point number in Cols. 13 and 14. This field must be left blank for subsequent entries if they are being repeated from previous entries.

<u>Pressures (Col. 15 - 74)</u>

Up to twelve pressures are entered in fields of ten starting in Column 15 and continuing to 74 for the first six, and again in Cols. 15 through 74 of a second card if necessary. The number of pressures needed depends upon the element being described. This information is delineated in detail in the section on element description.

REMEMBER:

- (1) For a problem with identical input for every element only the MODAL entry is required.
- (2) The repeat option can be used effectively for sets of elements that have the same input. However, element numbers <u>must</u> be entered consistent with the order in which they were entered in the Element Control Data section.
- (3) If the repeat option is used, leave the field for the number of pressures blank (Cols. 13 and 14) for subsequent entries if they are being repeated from previous entries.
- (4) If six or less pressures are entered, only one card is used for that particular element number. Do not put in an extra blank card.
- (5) The type of pressure input required for an element is a function of element type.

4. Element Pre-Strain and Pre-Stress Input Section (Figure II-15)

A prelabeled input data form is provided for element prestrain and pre-stress input. This form is used for elements which accommodate pre-strain and/or pre-stress input (Figure II-15).

The first entry on the input data form is prelabeled STST and requires no information from the user.

The second entry on the form identifies all the following information as pertaining only to strain, only to stress, or both strain and stress. Columns seven and eight are the only columns that contain information on the second card. An 'X' in Column 7 and Column 8 left blank identifies that only pre-strain data will follow. A blank in Column 7 and an 'X' in Column 8 means that only pre-stress data will follow. If both Columns 7 and 8 contain an 'X', both pre-strain and pre-stress data will follow. Note that this card must be present in an 'STST' input section, and an 'X'

				S	-				3	5	3	57)	3	*	2	(1)	2	~ ~ ;	Ø	33	(1)	(3)	3
					<u>ب</u>	3 -	-		<u>ب</u>	~	<u>-</u>				/-			-	ننم	 -		ن پسس	<u></u>
	;	•	77			į	. 4	77											<u> </u>			-	
	,		7	-		1	1 '	<u></u>		 	<u> </u>	<u></u>	-	-					-	-			
	RLEMENT PRESSURE INPUT		₩ 89			i								12									
	22 .		•	-	-	1			 	 	}		<u>.</u>			}			-				
	¥		-			1		\						- 53									
		1	200	<u> </u>		1		-	335				<u> </u>			- "-". -					-		
	20.2		3.4	L		ļ		-		<u> </u>		5.0		<u>.</u>					-				
	Mi Zi	Ì	~			1				2					2.5			<u> </u>		-		<u> </u>	_
	#		-			1		-		-		ļ	1				ď	``					
			•		-	1	*	100													خ ت	-ξ.	
		•	*	-	-	•	1	*		Ļ.	-	-	-					-					
						1	i .	- ا															
	3		2.5	-		`	10				٠				2		ت ت ت	<u>-</u> -		3	6 7		
			m] (2															
	\$2	S	7							×													
	io .	5	200				5	-				Ĭ	-	974	1				2.5		-		
	25	PRESSURES										h.,									-		
	23	×	~		 -			-					<u>, </u>			* :	<u> </u>		-		 -		
	₹ 8		88				7	\$			Ŷ.	-					·						
	≤ .π	=	8				•	~ <u> </u>								<u>`</u>							
	35	ELEMENT	. ~	-							-		_							,			
	<u> </u>	<u>.</u>	70				4	P							Ž				3	Ť.	7		
	Ĕ.E	ũ	:	 -			2		7	_	-			-	-	÷			-		-		
	35							`				•											-
			20.00			ľ	-	<u></u>												1 4			•
	MAGIC STRUCTURAL ANALYSIS SYSTEM INPUT DATA FORMAT		3.4								-	Į.						·			-		
	.8		L4				•	~			Ш												
	\{		m 0				65				. 0 -				-		i						
	•		-						٥														
			~				1	$\overline{}$					•						·	·			
		. 1	2 5			1	*	•				· ·	23.7			-					ľ		
	,		*				•	-															
			23				ĺ	\			·										Ť		
			20				7						,	-	-								-
	,		•				•	<u> </u>						I							П		
			7.8							•	۾ ي	·					į						
			5 6		1	1	_			-													
	SEINESI SEINESI	1	3.4.5		****			_	***		***		×××	·	***		***		***		***		888
L		A			*****	D. SECTION		7			***					, <u>, , , , , , , , , , , , , , , , , , </u>							
	,													7	***		***						
	-					1				-			***		***								
	5					Element		~				-					***						
	<u></u>		•		} '	les ense		ببسيات			***		1111			<u> </u>	*****	أممدست				أسبب	i i i
	<u> </u>		47	4																			
IC 2057	<u> </u>		*	-																			
Ž,	27 ~		N	90						30	6												

Figure II-14 - Element Pressure Input Data Form

must appear in either Column 7 and/or Column 8. No default, has been allowed for this card, and its omission is an error.

The third entry on the input data form is the MODAL entry. This entry allows the user to input pre-strain and/or pre-stress data (depending on what was indicated on card number two) which the System assumes to apply to every element unless otherwise indicated in the Element Number entries which follow the MODAL entry.

MODAL is pre-labeled in Cols. I through 5. Column 6 through 12 are left blank. The next sixty columns (Cols. 13 - 72) are divided into six ten column fields. If only pre-strain input is indicated on card two, six values of pre-strain are placed on this card. If only pre-stress input is indicated, six values of pre-stress are placed on this card. If both pre-strain and pre-stress are indicated, six values of pre-strain are placed on this card and six values of pre-stress are placed on the next card in the corresponding fields. The MODAL entry is optional and should be employed only when the User wishes to input pre-strain and/or pre-stress data for every element.

The following entries in this section contain information pertaining to Element Numbers, Repeat Option and Pre-Strain and/or Pre-Stress Input, e.g.,

Element Number - (Cols. 7 - 11)

- (1) Element numbers are entered as fixed point numbers.
- (2) Element numbers must be entered consistent with the order in which they were entered in the Element Control Data Section.

Repeat - (Col. 12)

The repeat option provides the User with the opportunity to repeat pre-strain and/or pre-stress input from element to element. This is accomplished in the following manner. If the input for a number of elements is identical, the User enters the element number and associated element input for the first element. For the following elements

having the same input, only the Element Number (Col. 7 - 11) and an 'X' in the Repeat column need be entered.

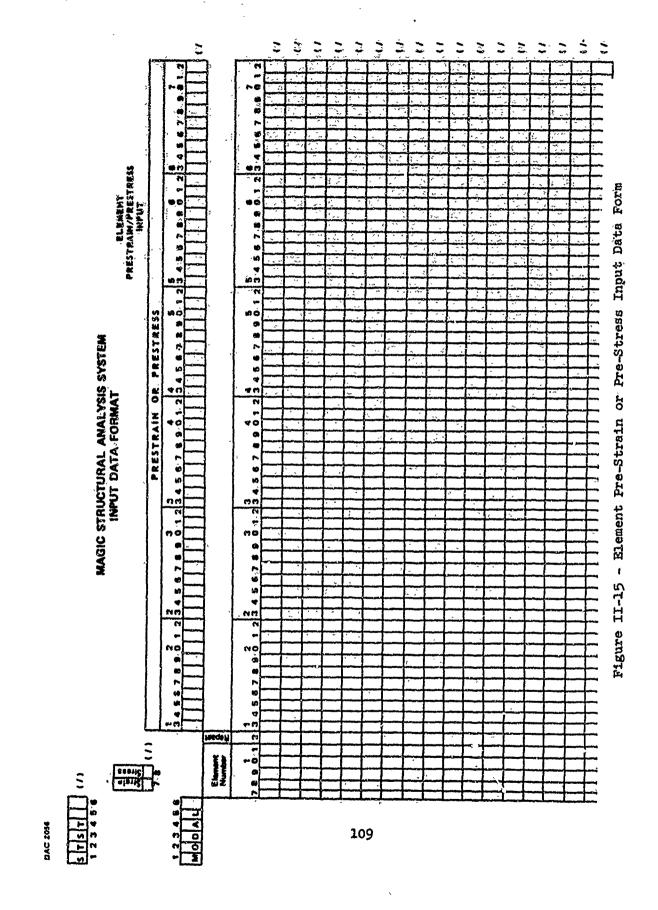
Pre-Strain or Pre-Stress Data (Col. 13 - 72)

The format of this data is analogous to that of the MODAL entry. One or two cards are used depending upon whether only pre-strain, only pre-stress, or both pre-strain and pre-stress are indicated on card number two.

The information describing the sequence of pre-strain or pre-stress data is element dependent and is presented for each of the applicable element types in the section on element description.

REMEMBER:

- (1) For a problem with identical input for every element only the MODAL entry is required.
- (2) The repeat option can be used effectively for sets of elements that have the same input. However, element numbers <u>must</u> be entered consistent with the order in which they were entered in the Element Control Data Section.
- (3) The type of pre-strain and/or pre-stress input required for an element is a function of element type.



5. Lumped Mass and Free-Free Input Section (Figure II-16)

Lumped structural and non-structural masses are specified by component against grid point number. The axes of reference are specified with reference to the Global System.

The labeled input data format provided for the Lumped Mass Section is shown in Figure II-16. A total of nine possible mass values are provided for in this section. These are as follows:

- (1) Three Direct Inerties (Mx, My, Mz)
- (2) Three Rotational Inertias (Mex. Mey, Mez) and
- (3) Three Generalized Inertias (M1, M2, M3).

The total number of degrees of freedom entries per grid point is dependent on the element type being employed in the analysis. Three types appear in the MAGIC III System, i.e.,

- (1) Triangular Cross-Section Ring, Trapezoidal Cross-Section Ring (Core) Three Degree-of-Freedom entries per point: Possible Inertia Values (M_x, M_y, M_z) .
- (2) Frame Element, Incremental Frame, Quadrilateral Shear Panel, Quadrilateral and Triangular Thin Shell Elements, Quadrilateral and Triangular Plate Elements, Symmetric Shear Web, High Aspect Ratio Quadrilateral Thin Shell, Tetrahedron, Triangular Prism, Rectangular Prism Six Degree-of-Freedom entries per point: Possible Interia Values (Mx, My, Mz, Mox, Mox, Moy, Mox).
- (3) Toroidal Thin Shell Ring Nine Degree-of-Freedom entries per point: Possible Inertia Values (M_X, 0, M_Z, 0, M_{Qy}, 0, M₁, 0, M₃). The M₁, 0 and M₃ are a set of generalized masses which correspond to non-physical derivative degrees-of-freedom for the toroidal ring. In general, these values are set equal to zero.

BAC 2004

The applicable concentrated masses are entered as floating point numbers. It is important to note that Keypunch Personnel have been instructed to ignore entries that are not filled in. Blank entries are not considered as zeros. Zeros must be entered in an entry when applicable.

The first entry on the Lumped Mass input data form is prelabeled MASS and requires no information from the User. The second entry is prelabeled SCALE in Columns 1-5 and the integer 1 in Column 11. The User supplies one item of information for this entry as follows:

Mass Scalar - (Cols. 13-22)

The Mass Scalar value is entered as a floating point number and is used when performing a free-free vibration analysis with or without condensation.

The value of the mass scalar corresponds to the value of the constant, Q_0 , which multiplies the assembled mass matrix. (Note the descriptions of free-free dynamics analysis (DYNAMICEF) and free-free dynamics analysis with condensation (DYNAMICSCF) which appear on pp. 82-84 and 92 of this report.)

It is noted that if a free-free analysis is <u>not</u> being performed, the mass scalar is not utilized. Furthermore, this input data form need only be utilized for the following:

- (1) Free-free vibration analyses with or without condensation and with or without lumped structural or non-structural masses.
- (2) Vibration analysis (rigid body modes suppressed) with or without condensation and with lumped structural or non-structural masses.

The next entry on the form is the MODAL entry. This entry allows the User to input a set of mass values which the program assumes to apply to every grid point unless otherwise indicated by a separate grid point entry on the grid point cards. MODAL is prelabeled on this card and the only information required by the User are the lumped mass values which have been discussed previously.

The third and following entries contain information pertaining to the Grid Point Numbers, Repeat Option and Lumped Masses, as follows:

Grid Point Number - (Cols. 7-11)

- (1) Grid Point Numbers are entered as fixed point numbers.
- (2) Grid Point Numbers can be entered in any sequence desired.

Repeat - (Col. 12)

The repeat option allows the User to repeat values of lumped mass from grid point to grid point. This is accomplished in the following manner. If the lumped mass values at a number of grid points are identical, the User enters the grid point number and associated lumped mass values for the first grid point. For the following points baring identical lumped masses only, the grid point number (Col. 7-11) and an "X" in the repeat (Col. 12) need be entered. If the repeat option is employed, only one card per grid point is required for the repeated entry irregardless of whether the degree-of-freedom entries per grid point are three, six or nine.

Remember:

- (1) The Lumped Mass input data section is utilized for the following:
 - a. Free-Free vibration analysis with or without condensation and with or without lumped structural or non-structural masses. Note that for free-free analysis a mass scalar value not equal to zero is required to properly perform the analyses as defined by the DYNAMICSF and DYNAMICSCF Agendums.
 - b. Vibration analyses with or without condensation (in which the rigid body modes have been suppressed) with lumped structural or non-structural masses. For this case the mass scalar value is set equal to 0.0 or it is not entered. If there are no lumped masses present, the form is omitted.
- (2) The Repeat option can be used effectively for sets of grid points having identical lumped masses.
- (3) Lumped masses are <u>not</u> element related and should not be confused with element generated mass matrices.
- (4) Zeros must be entered when applicable. Blanks are not zeros.
- (5) If the number of degree-of-freedom entries per grid point is equal to three (3) then only the inertia values (M_x, M_y, M_z) are applicable. The other two entries (Rotational and Generalized Masses) are ignored by the User.
- (6) If the number of degrees-of-freedom entries per grid point is equal to six (6) then the Translational and Rotational Inertia values must be considered. If, for instance, at a certain grid point there are translational inertias but no rotational inertias,

- zeros must be entered for the rotational inertia values or this entry will be ignored by the Keypunch Operator. This would cause premature termination of the run since six degree-of-freedom elements require two lumped mass cards per grid point.
- (7) If the number of degree-of-freedom entries per grid point is equal to (9), then Translational, Rotational and Generalized Masses must be entered. If some of these entries are equal to zero, these zero values must still be entered; otherwise, the entries will be ignored by the Keypunch Operator causing premature termination of the run.
- (8) Repeated grid points require only one card.

6. Element Control Data Section (Figure II-17)

The Element Control Data Section establishes control on the types and number of elements which are to be used in a specific analysis. A prelabeled input data form is provided for the Element Control Data Section and is shown in Figure II-17. This form is applicable to all finite elements which are contained in the MAGIC Library. Upon examination of the form, it is seen that certain data are applicable to all of the elements in the library while other data are element dependent.

The first entry on the form is prelabeled ELEM and requires no information from the User. The second and following entries contain the following information.

Element Number - (Cols. 7-10)

- (1) The element number which defines the element being considered is entered in this location.
- (2) Elements can be entered in any sequence desired.
- (3) The element number is entered as a fixed point number.

Plug Number - (Cols. 11-12)

- (1) Each additional finite element in the Element Library has an identification number as follows:
 - (a) Number 52 (Rectangular Prism)
 - (b) Number 50 (Tetrahedron)
 - (c) Number 51 (Triangular Prism and Symmetric Triangular Prism)
 - (d) Number 29 (Symmetric Shear Web)
 - (e) Number 38 (High Aspect Ratio Quadrilateral Thin Shell)
 - (f) Number 31 (Triangular Cross-Section Ring, Asymmetric Loading)
- (2) Identification Numbers are entered as fixed point numbers.

BAC 1628 Rev.

MAGIC STRUCTURAL ANALYSIS SYSTEM.
INPUT DATA FORMAT

ELEMENT CONTROL DATA

S S S S S S S S S S S S S S S S S S S	-		ن		}	<u>S</u>	<u>S</u>	3	<u>S</u>	<u> </u>	<u>S</u>	S	S	S	3	ં ઉ	S	: 3	S	: 3	ં ઉ	S	\mathcal{Z}	S	
		~	E	1	T	4	-	_			ĪΞ			I	1							T	T	T	1
1		=				-+	-	<u> </u>	 	├	ـــا		-	-	T.	150.			.15						T
	-		_		-	-+			-	ļ		ļ.,	 	-نيا	4~	-	۰,	-	-	1	1				Ι
	1	,			-	-}-		ļ,	نسل	<u></u>	ļ	٠	<u></u>	1	سبطه	1	1	1.	1	1	1.	1			Ι
0		_		-				سيبرا	ļ. 	ļ	ļ	ļ	ļ	-	ļ.,,	 	٠	ا ــــ	1	ļ.,			Ŀ		Ι
#	}	-			-	-	إب			4	سنسل	J.,	<u> </u>	-		1	<u></u>			:		1			Ι
## ## ## ## ## ## ## ## ## ## ## ## ##	1	á	-	-		- į ,		_	}		ــنــا	╁	<u>. </u>	٠.	4	1		_			L				I.
		Ξ	-		ĭ.	ĻĮ.			ļ	ļ.,	 	<u> </u>	ļ	!	<u>ا</u> ـــال	نا		<u>. </u>			1				I
				_	-	-		-	ļ	-	<u> </u>		<u></u>	!	1	1		100		L	<u> </u>				Ι
	1				┷┷		∤	-	<u> </u>			<u> </u>	تبنيا	ļ	1	ļ.,,	-								Ţ
	- 1	-			-				}			ļ	.	٠,	1	_	1_	1	1	1					Ι
		*****			-	-	-	-				<u> </u>	L	L	1	خصا	خبل		1						Ι
	- 1				<u>.</u>	٦.	_	·	-		<u> </u>				Ĭ.	1	L					£			Τ
0		•					ال			٠	<u> </u>				1 1		T	1	T.		1	T	Ţ		7
0	١,		1.	_			- 1			Ŀ	3						φ.				1	1	1		T
C C C C C C C C C C	-	_	· L .	<u> </u>											12.		7			-			-		۲
MONING OF THE PROPERTY OF THE	۱ د	}		1													1	1		1	<u></u>	1-0		-	۲
## ## ## ## ## ## ## ## ## ## ## ## ##	١,				Ĭ.,										Ě.			1				1	1		Ţ
			Section.	-	1		Γ_{i}					Ľ,	Ţ,		E	V_{\sim}	\$	1	Liferia		Ŀ	1	1		٢
## ## ## ## ## ## ## ## ## ## ## ## ##	ı	•		-	1		Ţ	_]	?	٠,			<u>. </u>). ·			. e		L	1		L			T
C	Į.					J	J	ė.		1							1			Ľŝ	Γ.				Τ
A COLUMN			_	_	1	T	آث										1	L							Γ
		•		1		1	ك]			ì., °						1		12.5				1		Γ
## ## ## ## ## ## ## ## ## ## ## ## ##					1.	Ŧ	I		•	.	3.	- 1		-	سيتل	7	1	1	-	-		· · · ·	1	-	t
A TO	Ð.,			· ·	J.	T	1			,	1.1				i de la constante de la consta	-	1	۰	,			-	-	-	۲
Seeming of the seemin	, J	4			Γ	I					1				1.	1	1	1	, ,,,,	ţ	1,5	_			t
C	L		7, 8		E	I				ų,			^		1	100	1	_	<u> </u>	1			1		۲
### ##################################	٦				Ŀ	T		'دد				~	*****		1	1	786	,	,			_	-		t
### ### ### ### ### ### ### ### ### ##	I	ri)	-		1	7	ŦĮ		100		,	5		_	├ ~~	}	1			-		 	-		۲
# # # # # # # # # # # # # # # # # # #	Ł				I		_				-		-	-	 	 	4			-((-		÷
MASSING OF THE PROPERTY OF THE	Т				\mathbf{I}	T.			Ŷ	1			wi.com		-	-		_	7		_	-	-		۲
#3843.8	1	e.			\mathbf{I}		T										†	-	~~~				-	-	t
AN SECOND CONTRACTOR OF CONTRA	Ŀ			<u>`</u>	1:.		Ţ		2			100				-	1	4							۲
MOMBESS A CONTRACT A CONTRAC	ľ				Γ	\perp	\Box	- 1			. ` `		Ü		-	-			•	_			,		۲
# # # # # # # # # # # # # # # # # # #	1.	-				\mathbf{I}	<u>:</u>								1	T.	1					,		* 1	r
Polymore Polymo	1		176		1:									· ·			1	-		-			_	~~~	T
# # # # # # # # # # # # # # # # # # #	aun'	860M	i w	,	Ŧ	Τ,	T	7									7							_	۲
A S S S S S S S S S S S S S S S S S S S	24	anduž		<u> </u>	<u> </u>	1_	_L		;}	,								, ;							ĺ
TO SEMENT	y y j	i facal	4		J.,].,	\Box	ÿ .	•						. ,		- 2					-	-		۲
# 1		ad in h N					\Box					14								-			-	_	۲
# 1	1	i) R ŝ	N				T						,	, ,										_	٣
WOMBON WORKING WORKING WORK -		-	<u>. </u>	٠.	٠.	_		انب		1					Ĺ.,	<u> </u>							. !	ŀ	
#366/00		• Male	ľz	•	1	1	- [- 1		- 1	1						Γ							·	Г
#366/00	Ŀ	والمراجعة المراجعة المراجعة		:::	1			اند		1						Ĺ								٠.	
#366/00		14149	ĺά			1	7	``	7		,	7		,	,	,	1							-	Г
WINDSWAN WINDSW	٠, ۲	<u>, </u>			<u></u>	<u>:</u>	\perp			لـنـ		٠			٠	١.			1						l
WINDSWAN WINDSW	ndu	Riom. II			1	Т	Ţ	-1	7		7					-	-	,	-	-		-		_	-
A CONTRACTOR OF THE PROPERTY O	٠	, 'ù	. 5	<u>'</u>	<u>L</u>	1.	.]_	-1				{	<u>. </u>	٠			., !							- 1	
A CONTRACTOR OF THE PROPERTY O	100	HISH		l		T	Т	T		- 1		Ť		,									-		
W C C C C C C C C C C C C C C C C C C C	13 Í	Bode M	١ ٨	l	1		1	1	1	ʻi	I	۱.	ŀ			7	ľ	ا, ا					ı		
E C C C C C C C C C C C C C C C C C C C						L	1			الــــ							<u> </u>	<u> </u>	{			<u>.</u>	_ }		L
E REMENTAL CONTRACTOR OF THE PROPERTY OF THE P	-	· W	1		<u></u>	F	T		\Box	ij										•					Г
E REMENTAL CONTRACTOR OF THE PROPERTY OF THE P	ب	E	-2				J	\bot			3														Γ
E REMENTAL CONTRACTOR OF THE PROPERTY OF THE P	≤	- F	9		٠	I	Ŀ	$oldsymbol{\mathbb{T}}$."			· ·		- 1						7	_	_	
E REMENTAL CONTRACTOR OF THE PROPERTY OF THE P	K	_ ≴	¥			L	I	\Box	- 1								1.7					~~	_	-	-
E REMENTAL CONTRACTOR OF THE PROPERTY OF THE P	M	<u> </u>	က				\perp	\perp			$\Box \Box$													_	_
E REMENTAL CONTRACTOR OF THE PROPERTY OF THE P	~	- <u>-</u>	~		_			\Box		\Box					,	1			. :		. 1				_
E REMENTAL CONTRACTOR OF THE PROPERTY OF THE P	¥	5	_=]			Ļ	Γ	J	\Box							<u> </u>								-	_
E REMENTAL CONTRACTOR OF THE PROPERTY OF THE P	u 2 -	<u> </u>			_	۲.	1				\Box														_
E C C C C C C C C C C C C C C C C C C C	::!	41210	: 9	۱ ^۰ ۱	l î		1	` [- 1	T	T	T	T		7		,	77		_	·		-	-	
E REMENTAL CONTRACTOR OF THE PROPERTY OF THE P	7	4.0101		1.4	_	ļ.,	4					لن		أحيي]		1	_ {	_	
S O O O O O O O O O O O O O O O O O O O	3				<u> </u>	ļ	4				\Box	\Box I	\Box		``. '										-
PENE NO	5	<u></u>		لنبنا	<u></u>	_	<u>.</u>		ــــــــــــــــــــــــــــــــــــــ			L													
PENE NO	K.	= 1			ــــــــــــــــــــــــــــــــــــــ	_	L		Γ	\perp I	_1	J					.]								
PENE NO	=	품		آئیا			\perp	\Box	$\Box \mathbf{I}$		\Box				· ·								_	-	_
PENE NO	4	ž			.*; ,		\mathcal{I}	7	;		,													-	-
			n				1/2	1		T		_		-1				-	-+	- 			-+		-
MARKATA	N :	PLUE	2	99.	-	Ĭ.:	I				7	-						_	┉┼					┷	-
M3M37x **			.0-				T	_		_	_	-	-				-+	-					-+		-
M3M37x **	_		-0				\mathbf{I}								-		्य	7	-		+		-	-	-
M3M37x **	26	man [a				I	I	\Box				\Box	3		-						_		-	_
	NZI	ברבא					T	T				\perp	\Box							_†			-	7	-
117				أننا						\Box	_]_	Ţ,	\Box T				T	T		\neg		<u> </u>	-	-	_

Figure II-17 - Element Control Data Form

Material Number - (Cols. 13-18)

The material number is the number of the material associated with the element in question. This number is referenced to the material tape. For instance, if the User were using material number 138, this material would have had to be on the tape at the time of the run or be a material that the User was adding to the tape for this particular run. The material number must appear exactly as it was in Cols. 10415 of the MATER section.

Temperature Interpolate Option - (Col. 19)

The Temperature Interpolate Option is exercised in the following manner:

- (1) If an entry is not made in Column 19, the program will average the node point temperatures of the element in question and use this average temperature when establishing material properties from the material tape.
- (2) If a 'l' is entered in Column 19, the program will use the Material Temperature entered in Columns 20-27 when establishing material properties from the material tape.
- (3) If a number n (n) 1) is entered in Column 19, then this number is equal to the number of node points which will participate in the averaging process.

 The first n node points entered in Columns 36-71 (Node Point Section), of the Element Control Data Section will then be used in the averaging process.

Material Temperature - (Cols. 20-27)

If the User exercises the Temperature Interpolate Option by placing a 'l' in Column 19, then a temperature associated with the element in question should be entered in Columns 20-27 in a thermal stress analysis. The program will then use this temperature when establishing material properties from the Material Tape.

Repeat Element Matrices - (Col. 28)

Element matrices generated for assembly against a particular finite element specification can also be used for the next element in the calculation sequence. This avoids repeated calculation of identical element matrices. Experience indicates a high frequency of opportunities for exploiting this feature. Input data requirements and execution times can be significantly reduced with use of this feature. The option is exercised by the User by placing an 'X' in Col. 28 opposite the Element Number for which element matrices are to be repeated.

Element Input - (Col. 29)

Certain of the additional elements contained in the MAGIC III System Element Library require element input. The rectangular prism, symmetric shear web, high aspect ratio quadrilateral thin shell, and triangular cross-section ring elements always require element input. An 'X' is placed in Column 29 for these elements.

A prelabeled input data form is provided especially for element input. This form will be discussed in detail immediately following the discussion of the Element Control Data input form.

Interpolated Input Print - (Col. 30)

If the User places an 'X' in Column 30, the following information is obtained:

- (1) Material Number
- (2) Material Identification
- (3) Type of Material; i.e., Isotropic or Orthotropic

- (4) Interpolated Material Properties, which include
 - (a) Temperature
 - (b) Young's Modulus
 - (c) Pulsŝon's Ratio
 - (d) Thermal Expansion Coefficients
 - (e) Rigidity Moduli

Element Matrix Print - (Col. 31)

If the User places an 'X' in Column 31, a print of element matrices associated with the element in question is obtained.

Full Print (Col. 32)

If the User places an 'X' in Column 32 a total print of all element matrices and intermediate computations is obtained for the element in question. In general, this option is exercised when debugging a problem.

Number of Input Nodes - (Cols. 33-34)

The number of input nodes is the number of node points which define an element. The following number of code points are applicable to the additional elements in the MAGIC Library.

(1)	Rectangular Prism	8	Node	Points
(2)	Tetrahedron	4	Node	Points
(3)	Triangular Prism	б	Node	Points
(4)	Symmetric Prism	3	Node	Points
(5)	Symmetric Shear Web	2	Node	Points
(6)	High Aspect Ratio Quadrilateral	8	Node	Points
(7)	Triangular Ring (Asymmetric Load)	3	Node	Points

Pressure Suppression Option - (Col. 35)

Pressure Load Matrices are generated at the element level in the MAGIC System. The User has the option of placing an "X" in Column 35, if it is desired to suppress the generation of the pressure Load Vector for any particular element.

Node Points - (Cols. 36-71)

These locations are reserved for the node points which describe the element in question. The User should note that three column fields are set aside for each node point. There are 12 locations set aside for node points.

7. Element Input Section - (Figure II-18)

A labeled input data form is provided for the Element Input Section. This form is used for elements which require Element Input: (Column 29 of the Element Control Data Section).

The first entry on the form is prelabeled EXTERN and requires no information from the User. The second entry on the input data form is the MODAL entry which allows the User to input element input which the program assumes to apply to every element unless otherwise indicated in the Element Number entries which follow the MODAL card. It can be seen from the input data form that the Element Input is labeled A, B, C, D, E, F with each item contained in a ten column field. These are the locations where the element input is entered, if the element being used requires element input. The entries made in Locations A through F are entered as floating point numbers. The values which are entered in these locations are functions of the type of element being employed in the analysis. This input, therefore, is element related and will be explained in detail for each element in the following section.

The third and following entries in the section contain information pertaining to the Element Numbers, Repeat Option and Element Input, i.e.:

Element Number - (Cols. 7-11)

- (1) Element Numbers are entered as fixed point numbers.
- (2) Element Numbers must be entered consistent with the order in which they were entered in the Element Control Data Section.

Repeat - (Col. 12)

The repeat option provides the User with the opportunity to repeat Element Input from element to element. This is accomplished in the following manner. If the element input for a number of elements is identical, the User enters the element number and associated element input for the first element. For the following elements having the same element input, only the Element Number (Col. 7-11) and an 'X' in the Repeat column need be entered.

REMEMBER:

- (1) For a problem with identical Element Input for every element only the MODAL entry is required.
- (2) The repeat option can be used effectively for sets of elements that have the same Element Input.
- (3) The type of element input required for an element is a function of element type. This element input will be completely described in the following sections.

					~ _	-		(1)	173	Ś	S	:	3	3	()	3	2	(7)	(1)	(1)	112	113
	- {		1.2			0 1 2																
•			70			NO	<u> </u>	÷	-	-	-	-	-	-	-	-	17.7		ا ٹ	-	اشا	
			5			•																1
		Ľ	7			8	<u> </u>	-		_	-	-	 	 	_	-	2 7	-	-		تست	
		;				249													-			
			*	-	٠,	*		<u> </u>	ļ.,	- 53	-	_	شيئة	<u> </u>	بنبر	-	-					-
	ļ		2.3			**				2.3	Ĭ.		3.		c,			n 24				
			**	-	- 1	* '3N	-	-	1 2		<u> </u>	-			-	نيز إ	ļ	ļ		-	-	
	. 1				·	***																
,	5					8.		-	-			-	-		-	-	-	-		-		
	2	ш			ŧ	7.1					100		<u>ن</u> `							1		
	E		*	l,	,		-		-			7.5	_	-	-	-	-		-	-		
		·	4		. `	4																
	ELEMENT INPUT	-	700	35.		, mm		-	-							3 3	bait			-		
	1		, - 90			17.00		c.		,										: :		7.
	1			•					127	<u> </u>	ÿ.		<u> </u>	V	_	uto =				<u> </u>	÷ .	<u> </u>
*	- 1	O			7	, #		7	* ,					7 (^ 5				
T.	ı	`.		<u> </u>		*	ہج	a a		.271	, ,		·	Z, 1	<u> </u>	<u> </u>	<u>`</u>	مختند		7, 1	-	<u>} </u>
₹	- 1	.	**				, ,,	t ,	^ > 2 \ \			Ĭ	: :5 %	(···								=
magic structural analysis system Input data forsant	Į	ٺ	400			44					٠٠٠			7. 140								
25		İ	~ 7.			9.01.2	<u> </u>		-	Ĩ			Ţ) () (, s		,			-
38	ĺ	į	Ť.	22		40					Ì	ľ	,						7	•		Ť
\$ I	:		#		*						· ·		سنت	23.5	18.7	, <u></u>				÷		
45		ပ	~				-							"	·					1.		
30	}	ı	. 10			•	, °	4						× .		٠ ار-						_
55	ا		•		Į	4				`		1		2.0	()	<u> </u>		``	-			コ
₹₹	ŀ	-	ů Č			nn N	* ÷		<u> </u>	-	5						÷			\$ 5		\dashv
5	I	ļ	ټ 0.ور			, mo					3 .)											
ؿۣ	ľ		, , , ,		. ,		·		<u>~</u>			,	· ·	- +		,				-		
5	4	ø	•		1		, ,		2	Ţ								<u>).</u>				IJ
2	[` .	_		·	,							·		,			
	Į		#.Z					Ţ			.0								·			
	-[NM		. [พดั											<u>. </u>					
	ľ	7	7		' '															٤	二	二
	1	ļ	70		.	, KÓ	•			-						+						
	1		. •	·	,	•								·				-				
		4	7,		}	6.7			· ·		-						-					ᅱ
	ı				Į	19																
	1		4:5			` 🔻	<u>, </u>							<i>j.</i>	-						_	
	Ĺ		17		Necto F	7	,															\exists
						1 2																-
					Number .	-0															二	二
	;			13	33						_							_				1
-			. 0			^																コ
8AC 1628-1	3 7 6		12345	MOD A L	,						12	3										

Figure II-18 - Element Input Date Form

8. Element Input Description

a. Rectangular Prism (Ident. No. 52)

The rectangular prism element, Figure II-19, is a powerful tool for the analysis of solid structures, thick plates and beams. It can be used in conjunction with the triangular prism and tetrahedral discrete elements for the analysis of arbitrary solid geometries, or with plate elements for the analysis of built-up regions. The shape of the element is defined by the coordinates of the eight corner points.

Trilinear Lagrangian interpolation formulas were used as assumed displacement functions in the development of the subject element. Due to the assumption of linear interpolation formulas, the edges of the prism remain linear in deformation. A direct consequence is that, although a single element may warp under a force-couple, it may not bend under any conditions. The foregoing assumed displacement functions lead to three translational displacement degrees of freedom at each of the eight corner grid points; thus, the complete element deformation is described by twenty-four (24) displacement degrees of freedom.

The element is written to accommodate three dimensional orthotropic material. Element stresses are given at the centroid of the element and include stresses due to displacements of the element (apparent stress), stresses due to the pre-strain state within the element and stresses due to temperature within the element. Two specific cases are denoted with respect to the pre-strain and thermal stress (and associated loads) states. These are called out under "Strain Control" below and represent a constant strain (or temperature) state throughout the element and a non-constant strain (or temperature) state throughout the element.

The following element matrices are provided for the rectangular prism in the MAGIC System:

STIFFNESS

STRESS

APPLIED LOAD (includes thermal, pressure and initial

strain contributions)

APPLIED STRESS (includes thermal and initial strain

contributions)

CONSISTENT MASS

Element referenced temperatures are provided by listing eight grid point temperatures on the Element Temperature Data Form (Figure II-13). The User has the option of calling out a constant temperature state or a temperature state which is of the same functional form as the assumed displacement mode shapes (i.e., trilinear Lagrangian interpolation formulas). The option is specified on the Element Input form as described below. Temperatures must be listed consistent with element numbering system.

The rectangular prism is provided with uniform pressures acting on the 6 faces of the element. The normal pressure is considered positive when acting away from the face in question (See Figure II-19). The pressures are input on the element level according to the Element Pressure Data Form (See Figure II-14). in the following manner:

Number of pressures = 6

Col.	15	ŭ	24	រំន	the	pressure	acting	011	face	1234
	25	•	34	is	the	pressure	acting	on	face	5678
•	35	-	44	is	the	pressure	acting	on	face	1458
	45	-	54	is	the	pressure	acting	on	face	2357
	55	-	64	is	the	pressure	acting	on	face	1256
	65	_	74	18	thë	pressure	acting	on	face	3478

Initial strains are input on the element level according to the Element Strain-Stress Input Data Form (See Figure II-15) in the following manner:

Col. 13 - 22 is \mathbf{e}_{xx} 23 - 32 is \mathbf{e}_{yy} 33 - 42 is \mathbf{e}_{zz} 43 - 52 is \mathbf{e}_{xy} 53 - 62 is \mathbf{e}_{yz} 63 - 72 is \mathbf{e}_{zx}

The element formulation does not use the initial stress data so blank cards must be inserted.

The element control data which is required for the Rectangular Prism Element is as follows (See Figure II-17).

Element Number - Cols. 7-10

Refer to Element Control Section.

Plug Number - Cols. 11-12

The Rectangular Prism Element is identified as Number 52.

Material Number - Cols. 13-18

Refer to Element Control Section.

Temperature Interpolate Option - Col. 19

If the User exercises this option by <u>not</u> making an entry in Col. 19, the program will average the 8 node point temperatures when establishing material properties from the material tape. If the user wishes to employ a specific number of node points, n, in the average process (1 < n < 8), then this number is entered in Column 19 and the first n node points entered in Cols. 36-71 will be used for the averaging process. If a "1" is entered

in this location, the program will use the material temperature entered in Cols. 20-27 when establishing material properties from the material tape.

Material Temperature - Cols. 20-27

Refer to Element Control Section.

Repeat Element Matrices - Col. 28

Refer to Element Control Section.

Element Input - Col. 29

The rectangular prism element always requires Element Input; therefore, an 'X' is always placed in Column 29 when a rectangular prism element is being used. The Element Input (Figure II-18) required for the Rectangular Prism consists of the following information:

Location A - Cols. 13-22

Strain Control, SC

- if SC = 0.0, the element is under a constant strain (temperature).
- if SC = 1.0, the element is not at a constant strain (temperature).

Returning to the Element Control Data Section, the list of data items continues as follows:

Interpolated Input Print - Col. 30

Refer to Element Control Section.

Element Matrix Print - Col. 31

Refer to Element Control Section

Pull Print - Col. 32

Refer to Element Control Section.

Number of Input Nodes - Cols. 33-34

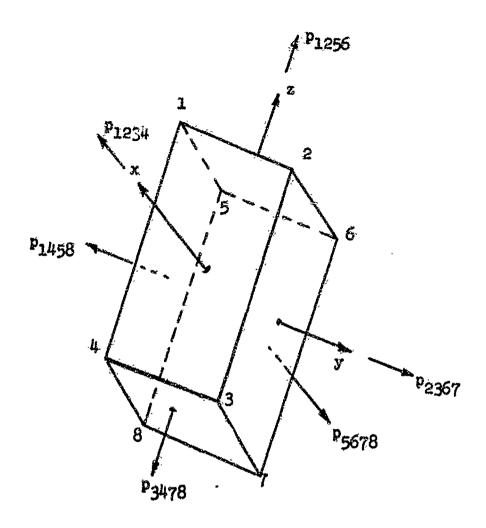
The Rectangular Prism Element is always defined by eight input nodes.

Pressure Suppression Option - Col. 35

Refer to Element Control Section.

Node Points (Cols. 35-71)

The Rectangular Prism Element is defined by 8 grid points.



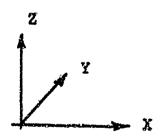


Figure II-19 - Rectangular Prism Element

b. Tetrahedron (Ident. No. 50)

The tetrahedron discrete element, Figure II-20, can be used to analyze solid structures such as beams and plates. It can also be used in conjunction with the rectangular prism and triangular prism solid elements and in fact is used to generate the triangular prism element. The shape of the element is defined by the coordinates of the four corner points.

A linear polynomial is used for each of the three displacement modes. These mode shapes lead to a total of twelve (12) undetermined coefficients for the element which are chosen to correspond to three translational displacement degrees of freedom at each of the four vertices of the element. The nature of the assumed displacement modes is such that the strains throughout the element are constant.

The element is written to accommodate three dimensional orthotropic material. Element stresses include stresses due to displacement (apparent stress), stresses due to the prestrain state within the element and stresses due to temperature within the element.

The following element matrices are provided for the tetrahedron in the MAGIC System:

STIFFNESS

STRESS

,,

APPLIED LOAD (includes thermal, pressure and initial strain contributions)

APPLIED STRESS (includes thermal and initial strain contributions)

CONSISTENT MASS

Element referenced temperatures are provided by listing four grid point temperatures on the Element Temperature Data Form (Figure II-13). These temperatures are then averaged in the MAGIC System to provide a weighted element input temperature. Temperatures must be listed consistent with element numbering system.

The tetrahedron is provided with uniform pressures acting on the 4 faces of the element. The normal pressure is considered positive when acting away from the face in question (see Figure II-20). The pressures are input on the element level according to the Element Pressure Data form (See Figure II-14) in the following manner:

Number of pressures = 4

Col. 15-24 is the pressure acting on face 134
25-34 is the pressure acting on face 234
35-44 is the pressure acting on face 124
45-54 is the pressure acting on face 123

Initial strains are input on the element level according to the Element Strain-Stress Input Data Form (see Figure II-15) in the following manner:

Col. 13-22 is ϵ_{xx} 23-32 is ϵ_{yy} 33-42 is ϵ_{zz} 43-52 is ϵ_{xy} 53-62 is ϵ_{yz} 63-72 is ϵ_{zx}

The element formulation does not use the initial stress data so blank cards must be inserted.

The element Control Data which is required for ... Tetra-hedron Element is as follows (see Figure II-17).

Element Number - Cols. 7-10

Refer to Element Control Section.

Plug Number - Cols. 11-12

The Tetrahedron Element is identified as Number 50.

Material Number - Cols. 13-18

Refer to Element Control Section.

Temperature Interpolate Option (Col. 19)

If the user exercises this option by not making an entry in Column 19, the program will average the 4 node point temperatures when establishing material properties from the material tape. If the user wishes to employ a specific number of node points, n, in the average process (1<n<4), then this number is entered in Column 19 and the first n node points entered in Columns 36-71 will be used for the averaging process. If a "î" is entered in this location, the program will use the Material Temperature entered in Columns 20-27 when establishing material properties from the material tape.

Material Temperature - Cols. 20-27

Refer to Element Control Section.

Repeat Element Matrices - Col. 28

Refer to Element Control Section.

Element Input - Col. 29

The tetrahedron element requires no element input.

Interpolated Input Print - Col. 30

Refer to Element Control Section,

Element Matrix Print - Col. 31

Refer to Element Control Section.

Full Print - Col. 32

Refer to Element Control Section.

Number of Input Nodes - Cols. 33-34

The tetrahedron element is always defined by 4 input nodes.

Pressure Suppression Option - Col. 35

Refer to Element Control Section.

Node Points - Col. 36-71

The tetrahedron element is defined by 4 grid points.

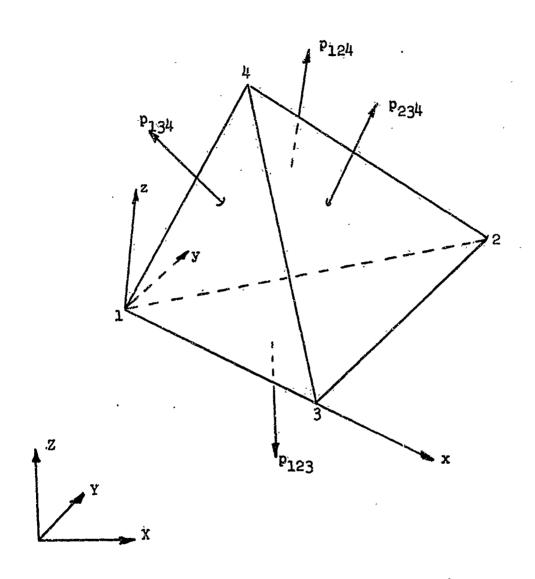


FIGURE II-20 - TETRAHEDRON ELEMENT

c. Triangular Prism (Ident. No. 51)

Three tetrahedrons are assembled as shown in Figure II-21 to form a triangular prism. Using this approach element matrices for three tetrahedrons are computed and assembled automatically within the MAGIC III System. A considerable reduction in input is realized which leads to a corresponding reduction in the possibility of input error when large scale analyses are performed. The input for one triangular prism element is identical to that for one tetrahedron except that six grid points define the prism instead of four which define the tetrahedron.

Element atresses are output for each tetrahedron which comprise the triangular prism. These include stresses due to displacement (apparent stress), stresses due to the prestrain state within the element and stresses due to temperature within the element.

The symmetric triangular prism finite element shown in Figure II-22 is a special case of the full, triangular prism element. This element was developed to eliminate conditioning problems inherent in the analysis of thin symmetric sections. As an example, in the analysis of aircraft wing or tail sections, the element can be used very effectively to model full-depth honeycomb core constructions which are used for shear transfer between the top and bottom skins. The use of this element allows the analysis to be performed using either the top or bottom symmetric half of the structure.

Appropriate boundary conditions are applied at the element level which specialize the full-depth prism into the symmetric element. The procedure employed in the reduction is as follows. Six tetrahedron elements are automatically assembled within the program with the three on the lower side of the axis of

symmetry being the mirror images of the corresponding three tetrahedrons on the upper side. This approach assures that symmetric and antisymmetric modes will uncouple when the element is specialized to a symmetric representation. Appropriate symmetric and antisymmetric boundary conditions are imposed on the centerline of symmetry at the element level. Based on these conditions, the degrees of freedom associated with the bottom symmetric half of the structure are expressed in terms of the remaining degrees of freedom. Thus, a transformation between deformations on the full prism and symmetric prism is derived which is used in a simple fashion to generate the desired matrices.

The following element matrices are provided for the triangular prism in the MAGIC system.

STIFFNESS

STRESS

APPLIED LOAD (includes thermal, pressure and initial strain contributions)

APPLIED STRESS (includes thermal and initial strain contributions)

CONSISTENT MASS

Element referenced temperatures are provided by listing six grid point temperatures on the Element Temperature Data Form (Figure II-13). Temperatures must be listed consistent with element numbering system.

The triangular prism is provided with uniform pressures acting on the 5 faces of the element. The normal pressure is considered positive when acting away from the face in question (see Figure II-21). The pressures are input on the element level according to the Element Pressure Data Form (See Figure II-14) in the following manner:

Number of pressures = 5

Col. 15-24 is the pressure acting on face 123

25-34 is the pressure acting on face 456

35-44 is the pressure acting on face 2365

45-54 is the pressure acting on face 1364

55-64 is the pressure acting on face 2541

Initial strains are input on the element level according to the Element Strain-Stress Input Data Form (See Figure II-15) in the following manner:

Col. 13-22 is 🕏 xx

23-32 is € _{yy}

33-42 is € zz

43-52 is 6 xv

53-62 is € _{yz}

63-72 is 6 _{2X}

The element formulation does not use the initial stress data so blank cards must be inserted.

The element Control Data which is required for the Triangular Prism Element is as follows (See Figure II-17)

Element Number - Cols. 7-10

Refer to Element Control Section.

Plug Number - Cols. 11-12

The triangular prism element is identified as number 51.

Material Number - Cols. 13-18

Refer to Element Control Section.

Temperature Interpolate Option - Col. 19

If the user exercises this option by <u>not</u> making an entry in Col. 19, the program will average the 6 node point temperatures when establishing material properties from the material tape. If the user wishes to employ a specific number of node points, n, in the average process

(1<n<6), then this number is entered in Col. 19 and the first n node points entered in Cols. 36-71 will be used for the averaging process. If a "1" is entered in this location, the program will use the material temperature entered in Cols. 20-27 when establishing material properties from the material tape.

Material Temperature - Cols. 20-27

Refer to Element Control Section.

Repeat Element Matrices - Col. 28

Refer to Element Control Section.

Element Input - Col. 29

The triangular prism element requires no element input.

Interpolated Input Print - Col. 30

Refer to Element Control Section,

Element Matrix Print - Col. 31

Refer to Element Control Section.

Full Print - Col. 32

Refer to Element Control Section.

Number of Input Nodes - Cols. 33-34

The triangular and symmetric triangular prism elements are always defined by 6 input nodes.

Pressure Suppression Option - Col. 35

Refer to Element Control Section.

Node Points - Cols. 36-71

The triangular prism element is defined by 6 grid points.

If node points 4, 5, and 6 do not exist (that is, are not input), the element then becomes a symmetrical triangular prism with the plane of symmetry being midway between node points 1, 2, 3 and node points 4, 5 and 6 (namely the XY plane of the structure - See Figure II-22).

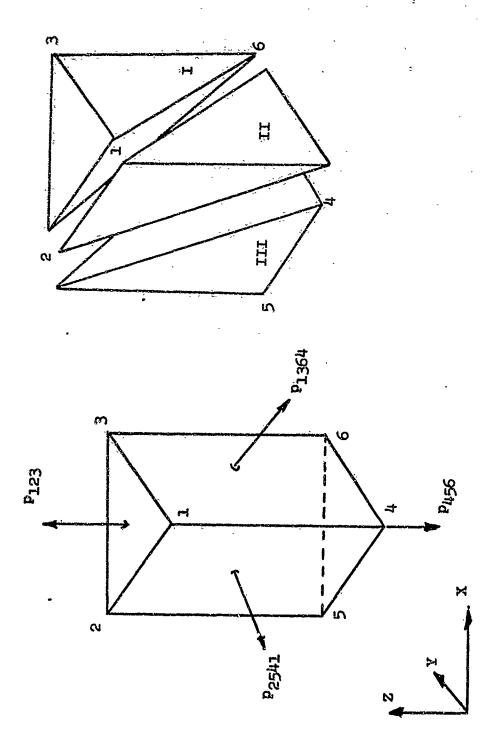


FIGURE II-21 TRIANGULAR PRISM ELEJENT

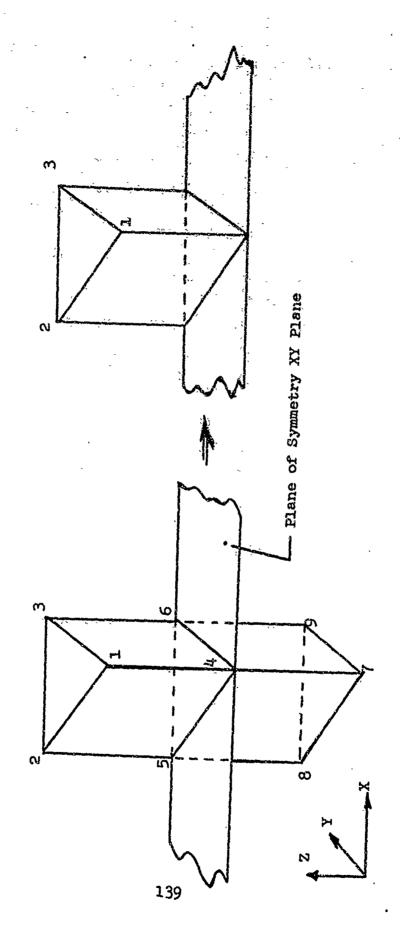


FIGURE II-22 SYMMETRIC TRIANGULAR PRISM ELEMENT

d. Symmetrical Shear Web (Ident. No. 29)

The symmetric shear web element as shown in Figure II-23 was developed to conduct analyses of the type discussed in the previous section, Section C.B.b, Triangular Prism. Appropriate symmetric and antisymmetric boundary conditions are imposed on the centerline of symmetry at the element level. Based on these conditions, element matrices can be readily derived using only the two upper grid points as reference points.

The assumed displacement method is utilized to derive the stiffness and stress matrices. These displacement functions in the local coordinate system are:

$$w(x) = b_1 + b_2 x + b_3 x + b_4 x$$

$$w(x) = b_1 + b_2 x + b_3 x + b_4 x$$

These functions yield six translational deformations, three translations at each of two grid points. Element stresses are evaluated at the midpoint of the element's length and yield the shearing stress at that point.

The following element matrices are provided for the symmetric shear web in the MAGIC System:

STIFFNESS

STRESS

The element Control Data which is required for the Symmetrical Shear Web is as follows (See Figure II-17):

Element Number - Cols. 7-10

Refer to Element Control Section.

Plug Number - Cols. 11-12

The Symmetrical shear web element is identified as Number 29.

Material Number - Cols. 13-18

Refer to Element Control Section.

Temperature Interpolate Option - Col. 19

If the user exercises this option by <u>not</u> making an entry in Col. 19, the program will average the 2 node point temperatures when establishing material properties from the material tape. If the user wishes to employ a specific number of node points, n, in the average process $(1 \le n \le 2)$, then this number is entered in Col. 19 and the first n node points entered in Cols. 36-71 will be used for the averaging process. If a "1" is entered in this location, the program will use the Material Temperature entered in Cols. 20-27 when establishing material properties from the material tape.

Material Temperature - Cols. 20-27

Refer to Element Control Section.

Repeat Element Matrices - Col. 28

Refer to Element Control Section.

Element Input - Col. 29

The symmetrical shear web element always requires Element Input. Therefore, an 'X' is always placed in Col. 29 when the symmetrical shear web is being employed.

The Element Input (Figure II-18) required for the symmetrical shear web consists of the following information:

Location A - Cols. 13-22

THICKNESS, (t)

The above is the only Element Input which is required for the shear web.

Returning to the Element Control Data Section, the list of data items continues as follows:

Interpolated Input Print - Col. 30

Refer to Element Control Section.

Element Matrix Print - Col. 31

Refer to Element Control Section

Full Print - Col. 32

Refer to Element Control Section.

Number of Input Nodes - Cols. 33-34

The symmetrical shear web element is always defined by 2 input nodes.

Pressure Suppression Option - Col. 35

Refer to Element Control Section.

Node Points - Cols. 36-71

The symmetrical shear web element is defined by 2 grid points.

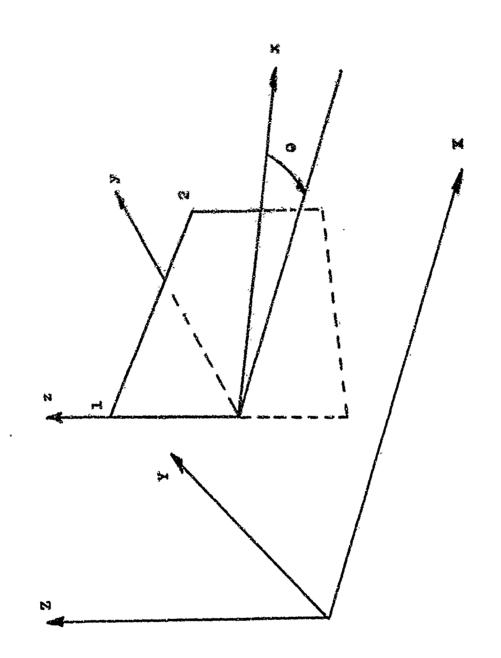


FIGURE II-23 - SYMMETRIC SHEAR WEB ELEMENT

e. High Aspect Ratio Quadrilateral Thin Shell (Ident. No. 38)

This finite element differs from the present MAGIC II quadrilateral thin shell element (Ident. No. 21) only in the approximation of in-plane behavior. No difference other than the identification number is eviden, to the User.

This additional finite element representation is included in the MAGIC III System for use in the idealization of membranes and plane-strain sections that require elongated finite element shapes. This circumstance is frequently encountered. One important class of applications requiring high aspect ratio finite elements is the stress analysis of structural joints. A rule of thumb that may be applied to guide the choice of element type for such applications is to use the modified quadrilateral thin shell element for those elements whose aspect ratio exceeds six.

All element matrices available to Element Ident. No. 21 are available to this element as well, i.e., stiffness, stress, distributed loading, thermal loading and consistent mass.

All input data required for this element is identical to that required for the original Quadrilateral Thin Shell (Ident. No. 21). Therefore, in the interest of conciseness, the reader is referred to Pages 175 thru 184 of Reference 5 for detailed element input description.

An example application utilizing this finite element is presented in Section II - C.8.e of this report.

f. Triangular Ring (Asymmetrical Load) - (Ident. No. 31)

The triangular ring (asymmetrical loading), hereafter called the asymmetric triangular ring, is a new tool which can be used for the analysis of thick-walled and solid axisymmetric structures of finite length. It may be used to idealize any axisymmetric structure taking into account

- 1) arbitrary axial variations in geometry,
- 2) axial variation in orientation of material axes of orthotropy,
- 3) radial and axial variations in material properties,
- 4) any asymmetric loading system including distributed mechanical and thermal loads.

The asymmetric triangular ring element and its accompanying applied mechanical loadings are pictured in Figure II-24. These mechanical loads are assumed evenly distributed over the loaded face, possessed of circumferential variation of magnitude and acting (or directed) parallel to the axial and radial direction of the ring (see Figure II-24). Positive directions of loading are illustrated in this figure. The complete theoretical development of this element is presented in the Engineer's Manual. A brief review of this development is given below.

The load and displacement fields for the asymmetric triangular ring element are assumed expressed in a Fourier series form in terms of the circumferential coordinate 9. Utilizing these expressions to write the total potential energy, the energy (and consequently the analysis) can be shown to decompose into an uncoupled form. Thus the three dimensional problem represented by an asymmetrically loaded solid of revolution can be solved by the carrying out of a sequence of two dimensional analyses. The resulting economy and accuracy introduced is obvious.

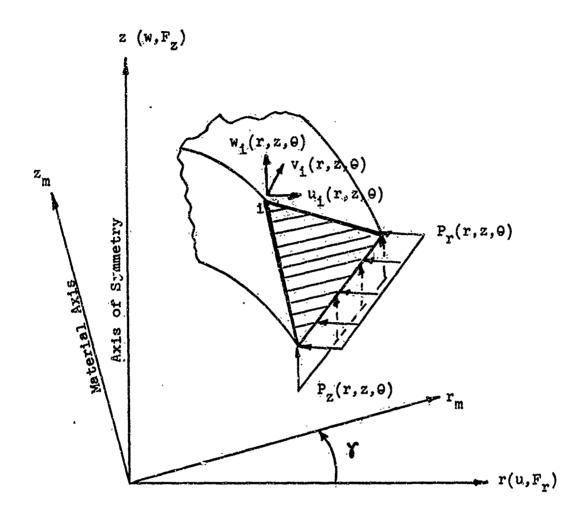


Figure II-24 - Triangular Ring Element (Asymmetric Loading)

The steps inherent in the analysis procedure can be listed as follows:

1) Utilizing input values of the applied load at regular circumferential stations around the structure, the Magic III program automatically generates a Jourier series representation of the loading system,

$$\{P\} = \{P_o\} + \sum_{n=1}^{\infty} \{P_n\} \{C_n\} + \sum_{n=1}^{\infty} \{P_n\} \{C_n\}$$
(1)

where $\{P_0\}$, $\{P_n\}$ and $\{P_n\}$ can be interpreted as harmonic load vectors and the diagonal matrices $[C_n]$ are composed of appropriate combinations of trigorometric elements. CosnO and SinnO.

- 2) The User specifies a maximum number of harmonics (m) to be considered in the analysis. In response to this definition, the Magic III program automatically selects the (m) most significant harmonics. The harmonics selected by the program are a function of the applied loading system.
- 3) (m) individual two dimensional analyses are then carried out. Harmonic displacements and stresses are obtained and combined to obtain the gross stresses and displacements of the structure.

An example of this analysis procedure is given below (with Reference to the theoretical development in the Engineer's Manual, Reference 9.)

Assume that a limit on the harmonic analyses has been set at three (m=3) and that the most significant description of the load system has been selected by the Magic III program as

$$\{P\} = \{P_0\} + \{P_1\} [C_1] + \{P_2\} [C_2]$$
 (2)

The following individual harmonic analyses are then carried out

$$\{P_i\} = [K_i] \{S_i\}$$
 $\{P_i\} = [K_i] \{S_i\}$
 $\{P_i\} = [K_i] \{S_i\}$
 $\{P_i\} = [K_i] \{S_i\}$
(3)

to determine the harmonic displacements [...], and [...] for the structure. The gross (actual) displacements of the structure [...] can now be determined by combining [...], [...] and [...] in the following series.

Harmonic [and actual stresses can be obtained in a similar manner.

The ring element geometry is defined with respect to cylindrical coordinate axes. The configuration of the element, as pictured in Figure II-24, is completely defined by specifying the radial and axial coordinates of the corner points.

The orthotropy (cylindrical anisotropy) is provided for in the mechanical and physical material properties of the ring element. The orientation of this orthotropy is assumed oriented in the ***, and ** directions (see Figure II-24). Transformation to the geometrical or structural system is accomplished utilizing the material angle ***.

The development of the asymmetric triangular ring element is an expansion of that utilized in deriving the axisymmetric triangular ring element (Ident. No. 40). Similar linear polynomial functions are employed in both elements and are employed for displacement mode shapes leading to constant element strain and stress states.

Due to the asymmetric deformations which the asymmetric ring can accomodate, 9 degrees of freedom (as opposed to six for the axisymmetric ring) are required to define the deformational behavior of this element. The predicted element stress behavior is constant over the triangular cross-section. Radial, circumferential and axial stresses are predicted. As in the axisymmetric ring element (Ident. No. 40) the asymmetric ring is numbered in the following manner. The element is numbered in the counter-clockwise direction.

A major difference between the two elements (asymmetric and axisymmetric ring), other than the accomodation of asymmetric loads in the former, is the interpretation of the applied loads themselves. Loads applied to the axisymmetric ring (Ident. No. 40) are assumed applied at grid points while loads applied to the asymmetric ring (Ident. No. 31) are assumed applied to the element.

In order to account for this difference as well as the circumferential variation of the magnitude of the loads an alternate set of load and data input cards must be provided to accomodate the asymmetric ring. These are provided and discussed in the discussion which follows. For solids of revolution subjected to axisymmetric loadings; it is suggested that the axisymmetric element be used.

The Element Control Data which is required for the Asymmetric Triangular Ring Element is as follows: (see Figure II-17)

Element Number - (Cols. 7-10)

Refer to Element Control Section

Plug Number - (Cols. 11-12)

The Triangular Cross-section Ring Element is identified as Number 31.

Material Number - (Cols. 13-18)

Refer to Element Control Section

Temperature Interpolate Option - (Col. 19)

Not available for this element.

Material Temperature - (Cols. 20-27)

Refer to Element Control Section.

Repeat Element Matrices - (Col. 28)

Refer to Element Control Section.

Element Input - (Col. 29)

To utilize this option, place an X in Col. 29.

The Asymmetric Triangular Cross-Section Ring Note: Element only requires Element Input under certain special conditions as follows: Referring to Figure II-24, it is seen that there is a possibility that in some cases the material axis, and element geometric axis of the element will not coincide. If this is the case the Element Input (Figure II-18) required for the Triangular Cross-Section Ring consists of the following:

Location A - (Cols. 13-22)

Material Axes Angle (Gamma - Υ_{mg})

Since the Triangular Cross-Section Ring Element is written to accommodate anisotropy of mechanical and physical properties, provision is made in the program for differences in orientation of material and element geometric axes for an element. User inputs the angle between the element material axis (X_m) and the element geometric axis (X_n) .

The angle gamma (Υ_{mg}) is input in <u>degrees</u> and is

considered positive when measured from the material axes to the element geometric axes, in a counter-clock-wise direction (Figure II-24).

Remember

Element Input is not required for the Triangular Ring if the material and geometric axes coincide,

i.e.,
$$\gamma_{mg} = 0$$
.

Interpolated Input Print - (Col. 30)

Element Matrix Print - (Col. 31)

Refer to Element Control Section

Full Print (Col. 32)

Number of Input Nodes (Col. 33-34)

The Asymmetric Triangular Cross-Section Ring Element is always defined by 3 input nodes.

Pressure Suppression Option (Col. 35)

Not available for this element.

Node Points - (Cols. 36-71)

The three node points which define each Triangular Ring are entered in the first three entires provided in the Node Point Section of the Element Control Data Form.

As previously mentioned an alternate set of load and data input cards are provided in the MAGIC III system to accommodate this particular element. These input cards replace the element pressure and temperature data cards shown in Figures II-14 and II-13 and are explained in detail below.

Stress and Displacement Output Section

The first entry on the input data form Figure II-25 is a prelabeled HSDC and requires no other information from the User. The second entry contains the reference, incremental and final circumferential angular values at which output stress and displacement data is desired. These entries are described below:

Reference Value Col. (7-11)

The entry in these columns is a fixed point right adjusted number representing the reference angle in degrees. The entry must not be less than zero nor greater than 359°.

Increment Value Col. (12-16)

The entry in these columns is a fixed point right adjusted number representing the increment value in degrees. The entry must not be less than 1° nor greater than 360°.

Final Circumferential Value Col. (17-21)

The entry in these columns is a fixed point right adjusted number representing the final circumferential value in degrees. This entry must not be greater than 360° .

Defining

RV = Reference Value

IV = Increment Value.

and FV = Final Value.

The following inequalities must hold

IV ← FV - RV

0 < FV - RV

The values defined above are utilized to define the region and quantity of information (output) desired for a given structure.

in chief it is

MAGIC STRUCTURAL ANALYSIS SYSTEM INPUT DATA FORMAT

TRIANGULAR RING ELEMENT (ASYMMETRIC LOADING) HARMONIC INGREMENTS

MSDC (/)

	-
	NO.
FING	α
£\$	88
	~
	2 8
.w	Ω
INC. VALUE	· L
=≼	80
	N
	-
	-0
REF VALUE	
* \$	8

Figure II-25 - Harmonic Stress and Displacement Output Control

Harmonic Pressure Loading Section

A pre-labeled input data form entitled HARM is provided for the entry of pressure load data and is shown in Figure II-26. The first entry on the form is labeled HARM and requires no other information from the User. The second entry pertains to the number of loaded elements, the maximum number of harmonics to be used per element, and the maximum number of output harmonics for the system. The third set of input data is concerned with element number, an element loading repeat option, the number of loading points and the harmonic pressure values. The last two sets of data must be input by the User and the instructions for doing so are described below. Entries on the second input data card, Figure II-26 are:

Number of Loaded Elements (Cols. 7-9)

The entry in three columns is a fixed point right adjusted number which represents the elements which have imposed pressure loads. Only the quantity of such elements is entered.

Number of Harmonics per Element (Col. 10)

The maximum number of harmonics to be used to represent the pressure loading for each element is entered as a fixed point number in column 10. This entry must be greater than zero and less than nine in value.

Number of Harmonics Output (Col. 11)

The maximum number of harmonics to be used in the calculation of output data for the entire element structure is entered as a fixed point number in column 11. This entry must be less than or equal to the number of harmonics per element.

Fries on the third and following input data cards Figure II-26, is described below:

MAGIC STRUCTURAL ANALYSIS SYSTEM INPUT DATA FORMAT

TRIANGULAR RING ELEMENT (ASYMMETRIC LOADING)
HARMONIC INCREMENTS

	FINC. VALUE	7 8 8 0
	INC. VALUE	2 3 4 5 6 7 8 9 0
S	REF	7.8 9 0 1
2 3 4 5 6		

Figure II-25 - Harmonic Stress and Displacement Output Control

Element Number (Cols. 7-9)

The number of the element on which the pressure load is to be applied is entered in Cols 7-9 using a fixed point right adjusted format. The element numbers are to be entered in ascending order and a maximum of 500 elements may be entered loaded.

Element Loading Repeat Option (Col. 10)

This piece of input data determines whether or not the element pressure loadings are to be repeated for succeeding elements. If these loadings are to be repeated the User enters an "X" in column 10 and omits remaining load data pertaining to this element. The pressure data from the proceeding element is automatically applied to this element. If these loadings are not to be repeated the User leaves column 10 blank.

Number of Radial Loading Points (Cols. 11-13)

The entry in these columns is a fixed point right adjusted number representing the number of points at which radial pressures will be defined. These points are spaced at equal intervals about the circumference of the element. The value of this entry must be greater than zero and less than 60 if a radial pressure is to be applied. If no radial pressure is present, a zero is entered and radial pressure values are omitted.

Number of Axial Loading Points (Cols. 14-16)

The entry in these columns is a fixed point right adjusted number representing the number of points at which axial pressures will be defined. These points are spaced at equal intervals about the circumference of the element. The value of this entry must be greater than zero and less than 60 if an axial load is to be applied on this element. Note that this entry does not have to be the same as the previous entry. If no axial pressure is present a zero is entered and axial pressure values are omitted.

Pressure Loading Values (Cols. 17-76)

The User enters pressure load values which are equal in quantity to the sum of the number of radial and axial loading points (Cols. 11-16). The radial values are entered first followed by the axial values. These values are entered in columns 17-76 in a floating point right adjusted format six to a card as shown in Figure II-26. A maximum of 20 such cards are allowed permitting a maximum entry of 120 pressure values per element. Note that the 2nd to 20th cards do not contain entries in columns 7 to 16. Pressures are applied on face number one (between nodes 1 and 2) and have same sense as the global coordinate system.

Harmonic Thermal Loading Section

A pre-labeled input data form entitled HTEM is provided for the entry of thermal load data and is shown in Figure II-27. The first entry on the form is labeled HTEM, and requires no other information from the User. The second entry pertains to the number of loaded elements, the maximum number of harmonics to be used per element, and the maximum number of output harmonics for the system. The third set of input data is concerned with element number, an element loading repeat option, the number of temperature loading points and the harmonic thermal values. The last two sets of data must be input by the User and the instructions for doing so are described below. Entries on the second input data card, Figure II-27 are:

Number of Loaded Elements (Cols. 7-9)

The entry in these columns is a fixed point right adjusted number which represents the elements which have imposed thermal loads. Only the quantity of such elements is entered.

BAC 2039 Sht. 1

No. Hermonics -- Output No. Hermeniss-Element -0 He, et Looded Elements

3

TRIANGULAR RING ELEMENT (ASYMMETRIC LOADING)

MAGIC STRUCTURAL ANALYSIS SYSTEM.

HARMONIC DEPENDENT ELEMENT PRESSURE LOADS

3 (/) 5 5 5555 3 3 4 5 **4**,7 **~**0 4 5 6 7 8.9 17 N •0 7 8 9 4.5 PRESSURE LOAD VALUES 77 8 # 0 # 3 4 5 6 7 7 0 4 8 2 34567880123456 1 2 7890 3456 Ne. of Axial Lecting Paints ialasii se ikadial Loeding Peinte 7 8 9 0 1 2 Refert Option momel 3 redmult,

Harmonic Dependent Pressure Loads Figure II-26

MAGIC STRIJCTURAL ANALYSIS SYSTEM INPUT DATA FORMAT

			\$	5	: 3	173	5	5	5	2	5		5	. 5		2	2	3	3	53	3.
			· L	I	L	I		I		1	I	I						Ī	Ī	Ť	Ť
8.				 	-		ļ.,	 	ـ	ļ.,	ļ_	_	L				Γ	E	I	I	
HARMONIC DEPENDENT ELEMENT PRESSURE LOADS (CONTINUED)				1	┪	 	┿	╬┈	┼-	 -	1-	┾	┦╧	 	├	-	┦~	+-	╂	╁┷	- }
	1	1 0	٠,	Ť.								Ε.					1		1	†—	_
	1		-	10°	-	 A	ļ	 -	-	-	-	_	-	-			I			1	
#33	j			ギー	1	-	╁	+	-	+	+-	-	-	├┷	 	1	╁┷	╁╌		╂	
A W.E	.l	à										1	<u> </u>	 	<u> </u>	 	†	+-	+-	 	+
5 Z Z	1	100					_														
養育の	l	8		 	ļ.,	 	-	+	{	 	┼	 	 	· · ·		_	-	1	_		ļ
3 2	i		-	┧—	 	-	┼	╅━	 	┼	+	┼				├	┪-	+	 	┼	-
포벨 :		, m		1			二					1.					上	<u> </u>		 	1
.		2	-	-	ļ	ļ	 	 - -	ļ	<u> </u>	<u> </u>										
				 	 	├	-	┼	├	├	 	-	 	├			├	┽	╂	}	-
		#0														-	-	+-	 	 	1
		90	-	ļ	,,,																
	1	-	 	╂╌╌	-	-	╁┷	┼	-	 	 	-		`		<u> </u>		-	ļ		
	1	8 9					-	1	ļ	 	1-	-	├ ∵		_	-	┯	╂	├	-	╂╼╾┥
	\$ 4																		1] 	
¥	1	2 3		├	-	 	<u> </u>	├-	-	<u></u>		_									
		-		 	 	 	 	 			├	├					├	╁┷	├-~		┼┤
\$		100																		_	
<i>n</i>	l iii			-	├	-		 	 -		_										
INPUT DATA FORMAT	LOAD VALUES	*	-	 	 	-	_	_			-	-					-	 	├		
ŽŽ	>	•	•			_											-	-	 ~	 	1-1
≨ 5	۵	\$				_					·										
ξ <u>π</u>	1 3	m		-	 	-	-	-		-	-	-	\vdash				-	├	├		
3 £] 3	14																			
2 5	w	40	-	├			-	-		-							Ш				
J. ₩ 	2			_	 	┢─	-				-							- -	 -	 	
35	PRESSUR	•															_				
ZZ	.W.	60	├	ļ	<u> </u>			-													
MAGIC STRUCTURAL ANALYSIS SYSTEM INPUT DATA FORMAT	a.	8	-	-	 	-	-	\vdash										-	 		
<u> </u>		*													_						
Š		2 3		<u> </u>		_								\neg							
8		-																			
		m0	<u> </u>	-		٠	_			·,											
		6	 ` 				-	-		-		-						\vdash			
	'	<u> </u>														_					
		- 0																			
		8	}	-	Ţ																
•		m									-	\dashv		-+	-						
		7																			
		40	-		_	_								_	_	_					
			-					-					-+	-+	⇥						
		20																			-
			-									_				\Box					
į	rinio a galbood					{								-+						_	
ş	He. of Axiel												士		一					_	
i	utnios gaibead	67	\Box				_	\neg			\Box	\Box	耳	\Box	\Box	コ					
i	He. of Redial	1 2										-+	-+		+						
ì	Releas Option	~0			_	-					-		+	+	┰	-					
i	Hampet	•										1	士		_	_	_	_		_	
i	Memena	7 8			_		_	\dashv	\Box	耳	二	\dashv	\Box	7	1	二			二	コ	
•									انت. 1	58											

Figure II-26 (Concluded)

Number of Harmonics per Element (Col. 10)

The maximum number of harmonics to be used to represent the thermal leading for each element is entered as a fixed point number in column 10. This entry must be greater than zero and less than nine in value.

Number of Harmonics Output (Col. 11)

The maximum number of harmonics to be used in the calculation of output data for the entire structure is entered as a fixed point number in column 11. This entry must be less than or equal to the number of harmonics per element.

Entries on the third and following input data cards, Figure II-27, is described below:

Element Number (Cols. 7-9)

The number of the element on which the thermal load is to be applied is entered in Cols. 7-9 using a fixed point right adjusted format. The element numbers are to be entered in ascending order and a maximum of 500 elements may be entered (loaded).

Element Loading Repeat Option (Cols. 10)

This piece of input data determines whether or not the element thermal loadings are to be repeated for succeeding elements. If there loadings are to be repeated the User enters an "X" in column 10 and omits remaining load data pertaining to this element. The thermal data from the proceeding element is automatically applied to this element. If these loadings are not to be repeated the User leaves column 10 blank.

HARMONIC DEPENDENT ELEMENT THERMAL LOADS " 0.12 * 9~ 4 0 1 2 TRIANGULAR RING ELFMENT (ASYMMETRIC-LOADING) MAGIC STRUCTURAL ANALYSIS SYSTEM INPUT DALA FORMAT 900 THERMAL LOAD VALUES 7.6 (4 40 • mr m o • 27 3 Repect Option No. of Temperature Teints No. Harmonics - Sieners No. Hermonics - Output tname!3 tedmuh No. of Localed Riements

113

()

Figure II-27 - Harmonic Dependent Temperature Loads

				-	•	-	<i>*</i>	5			S	3	~				3	(1)	()			=	3	3	1.1
			9	I	I			Ė	È	Ť	1	_	r	Τ.	_	-	_			T	-	_			
v	l	ĺ	-	+				\vdash	-	丁	7				土		士			+	+-	+	+		
¥ Š	İ		n		Ė	\pm		-	╁	╁	-	-	 	┼	╬	4-	\dashv		,		Ţ	T	コ	\Box	
3 7	_1		<u>~</u> -		1.	\Box	_	1	L	I	1				1	+	7		- ن	┼	+	+-	+		-
# E			·	- -	+	┽		[+	+	4			1			丁		<u> </u>		上	士	土	士	
HARMONIC DEPENDENT ELEMENT THERMAL LOADS	(CONTINUED)		• [I				†	+-	+	•	ļ	 	+	+	4	<u>j</u>	<u> </u>	┼	+	-	-	_	-
<u> </u>	E		•	T	I	I									十	+	7	-		╁╌	+-	╁	╬	\dashv	
3 -	8	-	<u>: -</u>	+-	+	- -		-	-	1_	1		<i>.</i>			1			_		Ť	1	十	+	<u>`</u> -
4 T	~	- 1	<u>.</u>	╁	╁			 	-	+	╬		٠ ,, :	├	1	<u> </u>	J.		·-		E	I	I	Î	
至到	}	- 1	• 🗀		1	\perp	_	-	-	†	+	-		┢	╁	+-	+	-		_	╁-	-	_		
m		5	<u></u>	-	T	丁										上	1	+		<u> </u>	┼-	╁	╼┾┷		
	j	1	<u>.</u> -	┿	╬	+			_	<u> </u>	4	4	-			\perp	I	\Box			1.	I	丁	1	
	ı			1		-	~		-	 	+	-	 	├	┼	╁╌	4-	-			ļ.,	T	Į	ユ	
	1	•		T	I	I									1	†. .	{	+		_	-	 - -	┽-	+	
	1			+-	4-	- -			<u> </u>	-	1	4				1	I	I					1	十	_
	1		-	+	+	╅	-	_		 - -	-	+	Į.	<u> </u>	 	4-	+	4					I	工	
	1.	4 '		I					` .		1	寸			 -	╁	┿	+			⊢	╁	+	+	
	1.	;	,	+-	╀	4	4			Ŀ	T	\Box				```	I	7				-	十	+	
	1	0	<u> ۱</u>	+	+-	┿	+				+-	+	-		<u> </u>	-	-	7	\neg		Ľ		工	工	_
.2	1			I	I		1				土	1			-	 -	╁	┰	-		-	├	╁	+	
1	ļ	"		╄	╁	+	+				L	Ţ							二	•			+	十	-
<u>×</u>	, is		•				7			 	╁╴	╅				 	╁	┪-	-	-			二	工	
Ø.	3	14:		_		Ţ	1				Ĺ					1	十	十	7		<u> </u>		+	+	-
MAGIC STRUCTURAL ANALYSIS SYSTEM INPUT DATA FORMAT	THERMAL LOAD VALUES			┼	┼	+-	4	-+			<u> </u>	I	\Box					工					+		-
38	>					1	+	-			╁	+	-			├-	╁	-	1				Ţ	工	コ
\$.5];				T	7					1	コ				士	+	_		•		┿	┿	-
₹*	₹			 	╂-	- [+	-			┼-	┿	-	-			L	Ţ	耳					工	ゴ
46	1 3	40			L		土	_		-	+-	+	+	-		-	╄	+	-				<u> </u>	Ţ.	コ
£ 2	1 .			<u> </u>		1	1	\Box				I	1	\Box				\pm	+		_		 	╫	-
ĔΕ	₹	100		 	┼	╁	╁	┯	-	·	 -	+-	+	-			_	Ţ	7	\Box				工	コ
22	2	6					İ	Ť	┷		1.0	┿	+	┪			├	┿	-	-				╀-	4
E E	<u> </u>	1 4		<u> </u>		I	Ţ	\Box	\Box			I						士		-			 	╁	+
()	=		_	_	-	┿	+				├-	╄	+	[_		匚	I	I					上	ゴ
ö		. 0				二	Ţ		\Box			土	士	士	コ			+	+	-+	-		├	+-	7
Ş	l	mo	 	├	┝	+	╁	+	-		├	┿	4	4	\dashv			T	7	\exists				上	I
_	1	0	_				1		寸			+	+	╅	\dashv		├	┼	+	}	-		-	╄-	4
	l	77	-	_		┼	1	4				Ï							土				-	+-	+
	Į.	9		_		├	╁	+	-+			╀	+	-				4_	_	\Box	\Box				I
	1	100					İ	士	_			╁	+	┪	┰			+-	+	-+				╄-	4
	1	l u				<u> </u>	1	1	7			Г	I						丁	\top				╁─	+
	ļ	1 00		_		-	┿	+	+			├-	+	+	-	_			T	\dashv				匚	1
		-							1			╁	+	+	╼┾		-	├	╬	+	-	, 		├	4
		00	\vdash	_			Ϊ.		1				I	I				<u> </u>	+-	十	+	\dashv		├	+
•		0				-	╀	+		-		<u> </u>	4						I						†
		-7					†	+	┿	-		-	┿	+	-+			├	╄	_	4	_			1
		5		**	***	333	×	80	#×	**		W	88	X Q	% &		***	200	3800	332.73		XX (4	2000	222	7
		*				2000 2000	***					33			$\mathbb{Z}_{\mathbb{Z}}$	10		200	3	**	W.	(X)	384		1
i	stnie¶					KITYY	٣	<u> </u>	7	~~~	Y.Y.			30	**	2327)	(0)					W	***	***	4
j	No. of equipments	~		_				T	I				L	士	工		-		+	+	+			-	ł
ł	notao tangag	-0	-+	-+			┝	+	+	4			T	1	丁	二			I	士	土	士			t
Ī	Number		_	-	{		┢	+	+	+			+-	╁	+			_	1	1	工	口			I
- 1	Insme!3	2	7	二	\Box			工	士	士			上	1-	+	-			+-	-}-	+	-+			ł
•	*****									Ţ	=									上	上	二	二		ł
										1	61														

Figure II-27 (Concluded)

Number of Thermal Loading Points (Cols. 11-13)

The entry in these columns is a fixed point right adjusted number representing the number of points at which thermal loads will be defined. These points are spaced at equal intervals about the circumference of the element. The value of this entry must be greater than zero and less than 60.

Thermal Loading Values (Cols. 17-76)

The User enters thermal load values which are equal in quantity to the number of thermal loading points (Cols. 11-13). These values are entered in Columns 17-76 in a floating point right adjusted format six to a card as shown in Figure II-27. A maximum of 10 such cards are allowed permitting a maximum entry of 60 pressure values per element. Note that the 2nd to 10th cards do not contain entries in Columns 7 to 13. Temperatures which are input are assumed applied to the element as a whole and must be interpreted as temperature changes (either increase (+) or decrease (-) from a thermal stress free state) to which the element is subjected.

SECTION III

INPUT AND OUTPUT OF MAGIC III SYSTEM

A. GENERAL DESCRIPTION

In this section, the proper interpretation of the input supplied to the MAGIC III system and the output supplied by the MAGIC III system is provided by reference to specific example problems. These examples will use the finite elements added to the MAGIC system; namely,

- 1) Rectangular Prism
- 2) Tetrahedron
- 3) Triangular Prism
- 4) Symmetric Triangular Prism
- 5) Symmetric Shear Web
- 6) Revised Quadrilateral Thin Shell
- 7) Triangular Cross-Section Ring

B. RECTANGULAR PRISM ELEMENT

A three-element cantilever beam subjected to an end moment is shown in Figure III-B.l as the first example. This figure shows the loading, idealization, dimensions and material properties. The preprinted input data forms associated with this example are given in Figures III-B.2 to III-B.10.

Figure III-B.6, Boundary Condition Section, shows the use of the MODAL and REPEAT options. There are 4 exceptions to the MODAL card (Grid points 1, 5, 9 and 13). Grid points 5, 9 and 13 have exactly the same boundary conditions as grid point 1, therefore the REPEAT option is employed by placing an ''X'' in column 12 opposite the entry for grid points 5, 9, and 13. Note that the four exceptions to the MODAL card are called out on the System Control Information Data Form, Figure III-B.4.

The following load data is evident by inspection of Figure III-B.7, External Loads Section.

- 1) One load condition is input.
- The external applied load scalar equals zero.

3) Grid point 4 is loaded with a force in the -Y direction equal to 66.66667 pounds. The REPEAT option is used for grid point 12 which is subjected to the same load. Grid point 8 is loaded with a force in the +Y direction equal to 66.66667 pounds. Again the REPEAT option is used for grid point 16 which is subjected to the same load. Note that no entries corresponding to External Moments are made since the rectangular prism element only admits translational displacements.

In Figure III-B.9, Element Input, it is noted that only the MODAL entry is used. This means that every element in this example problem is subjected to a constant pre-strain state. Reference to the Engineers Manual (Reference 7) shows that the User has the option of calling out a constant element pre-strain or temperature state or an element pre-strain or temperature state which is the same functional form as the assumed displacement mode shapes (i.e., trilinear Lagrangion interpolation formulas). It was decided to use the former in this problem, hence the entry 0.0 was made. The User must be aware of his choice and be consistent throughout the analysis. Actually in this problem no element prestrain or temperatures were considered so that either of the above options could have been chosen.

The output supplied by the MAGIC III system for this particular example is described below and shown in Figures III-B.11 to III-B.26.

Figure III-B.11 shows the matrix abstraction instructions associated with this example. A complete description of these instructions is provided in Reference 5. Figures III-B.12 to III-B.15 display the output from the Structural Systems Monitor. These figures record the input data pertinent to the problem being solved.

Figure III-B.12 displays the problem title and material data output. The gridpoint coordinates, temperatures and pressures are given in Figure III-B.13. Boundary condition information and finite element description is shown on Figure III-B.14. In the boundary condition portion of the figure, zeros ('0') represent degrees of

freedom that are fixed (i.e., no motion), ones ('i') represent degrees of freedom that are free or have unknown values of displacement, and twos ('2') represent degrees of freedom that are eliminated in the analysis procedure through the condensation technique. The second last column represents the cumulative number of degrees of freedom which actively participate in the equation solving process for displacements. The last column accumulates the number of two which participate in the calculation of the reduced stiffness matrix. The second portion of Figure III-B.14 shows the finite element description. Each of the three elements is called out in turn with grid points, print options and material number. Note that no extra grid points are listed nor needed for this element. The same comment also holds for section properties since all pertinent data are calculated within the program.

Figure III-B.15 displays the external load condition and the transformed external assembled load column. This 48 x 1 vector is the total unreduced load which is read row-wise. The ordering of this vector is consistent with that of the boundary condition table given in Figure III-B.14. Note that a load of 66.66667 pounds is applied at node point 4 in the negative global Y direction. This is position (11,1) in the load vector which corresponds to the eleventh entry in the boundary condition table which is the global V displacement for node point 4. The other loads shown follow the same pattern.

MAGIC III system output of final results are displayed in Figures III-B.16 to III-B.26. Figure III-B.17 shows the stiffness matrix for this problem. It is noted that only the non-zero terms are displayed. The stiffness matrix is presented row-wise and its ordering is consistent with that of the boundary condition table previously discussed. In this problem the ordering is

$$\{\Delta\}^{T} = [v_2, w_2, v_3, w_3, \dots, v_{16}, w_{16}]$$

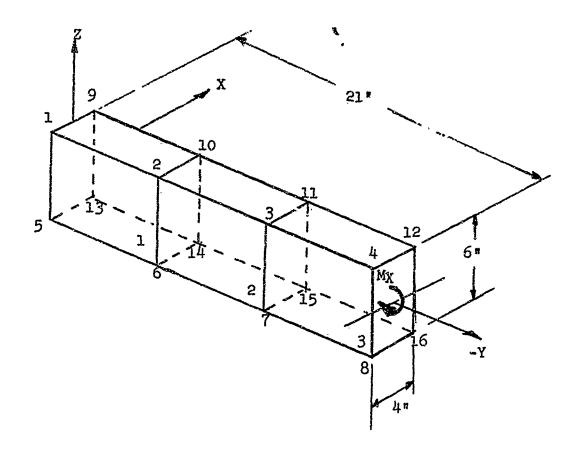
The externally applied load vector (GPRINT OF MATRIX LOADS)

is presented in Figure III-8.18. This figure shows that forces (F_Y) are applied in the negative and positive global Y directions at node points 4, 8, 12 and 16. These forces are numerically equal to ± 66.66667 pounds and are directed to form a moment of $M_X = 800$ in. pounds applied at the tip of the cantilever.

The displacements of the cantilever beam resulting from the above loads are given in Figure III-B.19. It is noted that the displacements (U, V, W) are output corresponding to node point number and are referenced to the global axes unless otherwise specified. Figure III-B.20 shows the reactions (F_X, F_Y, F_Z) . These are output corresponding to node point number and are referenced to the global axes system unless otherwise specified.

The stresses arising in the structure are displayed in tabular form in Figures III-B.21 to III-B.23. Stresses are referenced to the local coordinate system and for this element are defined at the centroid. Six stress values are printed for the apparent element stress, element applied stress and net element stress categories. The apparent stress arises from element deformations and the applied stress arises from pre-strain and thermal effects. The net stress is the difference between the apparent and applied stress values. These stresses are given mathematical symbolism description in Reference 7.

The last set of output is given in Figures III-B.24 to III-B.26 and consist of the global oriented element forces. Three sets of forces are given and are categorized as above. The forces points 1 through 8, in this example, correspond to element grid point numbers. For element number one, for example, force points 1, 2, 3, 4, 5, 6, 7, 8 correspond to element grid points 1, 2, 6, 5, 9, 10, 14, and 13 respectively.



$$E_X = E_Y = E_Z = E = 30.0 \times 10^6 \text{ psi}$$
 $V_{XY} = V_{YX} = V_{YZ} = V_{ZY} = V_{ZX} = V_{XZ} = V_{XZ} = 0.333$
 $P = .00073395 \# \text{sec}^2/\text{in}^4$
 $E_X = V_Y = E_Z = 0, T_1 = T_2 = ... T_{16} = 0.0$
 $M_X = 800 \text{ in.lbs.}$

FIG. III-B.1 RECTANGULAR PRISM ELEMENT - CANTILEVER BEAM WITH END MOMENT 167

BAC 1815

REPORT (/)

MAGIC STRUCTURAL ANALYSIS SYSTEM INPUT DATA FORMAT

TITLE INFORMATION

THIS IS THE FIRST ENTRY ON ALL REPORT FORM INPUT RUNS AND IT IS REQUIRED FOR ALL RUNS.

5

NUMBER OF TITLE CARDS

13456-100										
THE CANAL CANTER ED 1234567890 123456789	- KI						Ť			
THREE ENGINE AND STATE OF STAT	_ -	!		 	{	-				}
THREE ENGINE AND STATE OF STAT	·	╂╼╼╂		}						
THREE ENGINE AND STATE OF STAT	^D	J					1	ļ	<u> </u>	
THREE ENGINE AND STATE OF STAT	Øį	1 L			لسنا					
THE ELEMENT CANTEL WIENER SURSECTED TO STATE TO	60	1 1								
THE ELEMENT CANTAL STEED SCHOOL STATE STAT	~	1 1								-
THREE ELEMENT CANTEL BY ERED GENN SUBSECTED TO AND END STATE	•	1	_							
THE STATE OF		ţ		+				-		
THIRGE ELEPENT CANTEL GUERE D REGAM SUISSECTED THE AND ELEMENT INDENT TO MAN ELEMENT STATES AND SUISSECTED THE AND ELEMENT INDENT TO MAN ELEMENT TO MAN ELE		1 1							f	<u> </u>
Thirde Ehebent Toland China Petals Pe		1 1				ļ		ļ	<u> </u>	
THIRGE ELEPENT CANTILL STARTS CONTRIBUTED TO STARTS CONTRIBUTED TO STARTS TO	(1)	jį		لنا						
THIRGE ELEPENT CANTILL STARTS CONTRIBUTED TO STARTS CONTRIBUTED TO STARTS TO	34] [} {
1334 8 6 7 3 3 4 8 6 7 3 3 4 8 6 7 3 4 8 7 3 4 8 6 7 3 4 8 7 3 4 8		1 1								
1334 8 6 7 3 3 4 8 6 7 3 3 4 8 6 7 3 4 8 7 3 4 8 6 7 3 4 8 7 3 4 8		1		1-51						
1334 8 6 7 3 3 4 8 6 7 3 3 4 8 6 7 3 4 8 7 3 4 8 6 7 3 4 8 7 3 4 8		4 H		-e	}					}
1334 8 6 7 3 3 4 8 6 7 3 3 4 8 6 7 3 4 8 7 3 4 8 6 7 3 4 8 7 3 4 8	0	1 1			/			ļ	ļ	
1334 8 6 7 3 3 4 8 6 7 3 3 4 8 6 7 3 4 8 7 3 4 8 6 7 3 4 8 7 3 4 8	80	j		121		ļ		سيئيا		
1334 8 6 7 3 3 4 8 6 7 3 3 4 8 6 7 3 4 8 7 3 4 8 6 7 3 4 8 7 3 4 8		Ji								
1334 8 6 7 3 3 4 8 6 7 3 3 4 8 6 7 3 4 8 7 3 4 8 6 7 3 4 8 7 3 4 8	6 0]		2						
1234 5 5 1 2 3 4 5 5 7 5 9 5 1 2 3 4 5 5 7 5 7 5 7 5 7 5 7 5 7 5 7 5 7 5 7	6.2			T						
1234 5 5 1 2 3 4 5 5 7 5 9 5 1 2 3 4 5 5 7 5 7 5 7 5 7 5 7 5 7 5 7 5 7 5 7	- 15	1 1		e						
Three Stat	10.38	1 1								
THINKEE ELEMENT CANTILLE VERED CONTRING TO CONTRICT TO CHANGE TO CONTRICT TO CHANGE TO CONTRICT TO CHANGE TO CONTRICT TO CHANGE TO CONTRICT TO CHANGE TO CONTRICT TO CHANGE TO CONTRICT TO CHANGE TO	177	4 F		إسلسغ					 	
THINKEE ELEMENT CANTILLE VERED CONTRING TO CONTRICT TO CHANGE TO CONTRICT TO CHANGE TO CONTRICT TO CHANGE TO CONTRICT TO CHANGE TO CONTRICT TO CHANGE TO CONTRICT TO CHANGE TO CONTRICT TO CHANGE TO	NE	, ,		أسيط	<u> </u>			<u> </u>	-	
THINKEE ELEMENT CANTILLE VERED CONTRING TO CONTRICT TO CHANGE TO CONTRICT TO CHANGE TO CONTRICT TO CHANGE TO CONTRICT TO CHANGE TO CONTRICT TO CHANGE TO CONTRICT TO CHANGE TO CONTRICT TO CHANGE TO	-1-8	لــــــا		1 El	لـــــــــــــــــــــــــــــــــــــ					
THIREE ELEMENT CANTILLEVERED BEAM SURS MOMENT: RECTANGULAR PRIEMENT IND STATICS ANALYSIS CONCENTRATED LOADS	NO.		M	6	أسيا			J	ا ا	
THIREE ELEMENT CANTILLEVERED BEAM SURS MOMENT: RECTANGULAR PRIEMENT IND STATICS ANALYSIS CONCENTRATED LOADS	0 ·6	<u> </u>	in]	C						لـــا
THIREE ELEMENT CANTILLEVERED BEAM SURS MOMENT: RECTANGULAR PRIEMENT IND STATICS ANALYSIS CONCENTRATED LOADS	∞ }	1 I								
THIREE ELEMENT CANTILLEVERED BEAM SURS MOMENT: RECTANGULAR PRIEMENT IND STATICS ANALYSIS CONCENTRATED LOADS	7	1 1	45	130						
THIREE ELEMENT CANTILLEVERED BEAM SURS MOMENT: RECTANGULAR PRIEMENT IND STATICS ANALYSIS CONCENTRATED LOADS	w A	1 F	7		-		 			
THIREE ELEMENT CANTILLEVERED BEAM SURS MOMENT: RECTANGULAR PRIEMENT IND STATICS ANALYSIS CONCENTRATED LOADS		┞	- 	∤- %}-						
THIREE ELEMENT CANTILLEVERED BEAM SURS MOMENT: RECTANGULAR PRIEMENT IND STATICS ANALYSIS CONCENTRATED LOADS		j ļ				ļ	ļ			ļļ
THIREE ELEMENT CANTILLEVERED BEAM SURS MOMENT: RECTANGULAR PRIEMENT IND STATICS ANALYSIS CONCENTRATED LOADS	VI	į	-	121	ļ		 		 	[]
THIREE ELEMENT CANTILLEVERED BEAM SURS MOMENT: RECTANGULAR PRIEMENT IND STATICS ANALYSIS CONCENTRATED LOADS	≈ <u>U</u>	J [3	3						
THIREE ELEMENT CANTILLEVERED BEAM SURS MOMENT: RECTANGULAR PRIEMENT IND STATICS ANALYSIS CONCENTRATED LOADS	W 10	1 [10	[W]						
THIRE ELEMENT CANTLL EVERED LOS	+ N		7	-				ļ ,		
THIRE ELEMENT CANTLL EVERED LOS	+c 2	11	. 6-1	10						
THIRE ELEMENT CANTLL EVERED LOS	7	1 1								
THIRE ELEMENT CANTLL EVERED LOS	T	1 1					ļ -			
THIREE ELEMENT CANTIL EVERED EERA I MOMENT I RECTANGULAR PRISH ELEM STATICS ANALYSIS CONCENTRATED		4 !		131	<u> </u>				-	
THIREE ELEMENT CANTIL EVERED EERA I MOMENT I RECTANGULAR PRISH ELEM STATICS ANALYSIS CONCENTRATED	~		- 21	رورا			<u> </u>	ļ		
1.2348678961.234887888898989898989898989898989898989898	∞ _∑		<u> </u>							
1.2348678961.234887888898989898989898989898989898989898	10	1	2			L				
1.2348678961.234887888898989898989898989898989898989898	₹ ₩] [U)							
1.2348678961.234887888898989898989898989898989898989898	m 10	1								
1.2348678961.234887888898989898989898989898989898989898		1 1	-111		·					
1.234567396723456 1.17NREE EREMENT CANTILLE 1.17NRENT RECTANGULAR 1.17NRECTANGULAR 1.17NRECTANGULAR 1.17NRECTANGULAR 1.17NREE EREMENT CANTILLE		1 1								
1.234567396723456 1.17NREE EREMENT CANTILLE 1.17NRENT RECTANGULAR 1.17NRECTANGULAR 1.17NRECTANGULAR 1.17NRECTANGULAR 1.17NREE EREMENT CANTILLE	ma	-		+ 30+						
1.234567396723456 1.17NREE EREMENT CANTILLE 1.17NRENT RECTANGULAR 1.17NRECTANGULAR 1.17NRECTANGULAR 1.17NRECTANGULAR 1.17NREE EREMENT CANTILLE	(,)	1		14	-			 	<u> </u>	├ ──┤
1.234567396723456 1.17NREE EREMENT CANTILLE 1.17NRENT RECTANGULAR 1.17NRECTANGULAR 1.17NRECTANGULAR 1.17NRECTANGULAR 1.17NREE EREMENT CANTILLE	e a	1 1							ļ	<u> </u>
1.234567396723456 1.17NREE EREMENT CANTILLE 1.17NRENT RECTANGULAR 1.17NRECTANGULAR 1.17NRECTANGULAR 1.17NRECTANGULAR 1.17NREE EREMENT CANTILLE	ω <u>ιι</u>			12						<u> </u>
1.234567396723456 1.17NREE EREMENT CANTILLE 1.17NRENT RECTANGULAR 1.17NRECTANGULAR 1.17NRECTANGULAR 1.17NRECTANGULAR 1.17NREE EREMENT CANTILLE	N 39	1	0.				i [· •		
1.23 4 5 6 7 2 3 4 5 6 7 8 9 2 1 2 1 2 3 4 5 6 7 8 9 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2	20 VB] [0	FU						
1.23 4 5 6 7 2 3 4 5 6 7 8 9 2 1 2 1 2 3 4 5 6 7 8 9 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2	0			12						
1.23 4 5 6 7 2 3 4 5 6 7 8 9 2 1 2 1 2 3 4 5 6 7 8 9 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2		1 1	न्हर्ग	一云						11
1.23 4 5 6 7 2 3 4 5 6 7 8 9 2 1 2 1 2 3 4 5 6 7 8 9 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2	<u> </u>	4 4	- 40		 		 	 	 	
123456739 0 133456789 	:: - L	4 1		الخبر	1	 	 			} }
123456739 0 133456789 	7	4 1	_=	 		 	 		 	
123456739 0 133456789 	-LS	<u></u> _	<u> </u>	160				<u></u>		
123456739 0 133456789 	40 U	j l	ড			3				
1.23 4.8 6.72 8 0 1.2 1.1 THIRGE ER			F-1	IM			1			
1.23 4.8 6.72 8 0 1.2 1.1 THIRGE ER		1 1	4			. 5-100	E	i		
1.23 4.8 6.72 8 0 1.2 1.1 THIRGE ER		1 1	-2		ļ!					L1
1.23 4.8 6.72 8 0 1.2 1.1 THIRGE ER		1 1	द	图						
1.23 4.8 6.72 8 0 1.2 1.1 THIRGE ER		1 1	्रम्	图						日
1.23 4.8 6.72 8 0 1.2 1.1 THIRGE ER		1 1	ट्रमुक	To the second				<u>.</u>		耳
1.23 4.58.72.9 0.1 1.23 4.1 1.24 4		1 1	E CTP	MALM						
1.23 4.58.72.9 0.1 1.23 4.1 1.24 4		1 1	RECTA	MANA MA				. =		=======================================
1.23 4.58.72.9 0.1 1.23 4.1 1.24 4		1 1		1				·		
		1 1		1				·		
	123456789 Element	1 1		1						
	123456789 Element			1						
	123456789 Element			1						
	123456789 Element			1						
	123456789 Element			1						
	123456789 Element			1						
	6729 0123456789 TW REE ELEPE NT			1						
ARBBBBBBBBBB	567290123456789 THIREE ELEPTON			1						
ARBBBBBBBBBB	567290123456789 THIREE ELEPTON			1						
	4567290123456789 THIREE ELEMENT			1						
	3 4 5 6 7 2 9 6 1 3 3 4 5 6 7 8 9 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7			1						
168	234567296123456789 			1						
	234567296123456789 		- MoMent	STATIS						

FIGURE III-B.2 TITLE INFORMATION - RECTANGULAR PRISM ELEMENT, CANTILEVER BEAM

ĺ

BAC 1616-1

123456 723456

MAGIC STRUCTURAL ANALYSIS SYSTEM INPUT DATA FORMAT

MATERIAL TAPE INPUT

S

<u>}</u>	2 3 4	8	-			()	6.7.3	673	~ ~ ~	(7)	<i>{ \ }</i>	2		1.13	S	3
HASS DENSITY	60	ड़			8		~	, 	<u> </u>	<u> </u>	<u> </u>	_	ř		_	r ː
2	9	-	1	1 -						-						
3		Ö	ļ	1 2	80											
	- 6	00	1] §	- 8		ļi	-	-	 	}	-	<u>-</u>		-	
	100	•	1	1 8	-						_					
Number of assistant	3.4	0		SIGNOTA MODELL	8				-							
to wednuth art. J'safe	48	7440	1	"	200			<u> </u>								
Frint Mart. Vienemus	8			uòp	oniG	Š	24	, H		·	L	¥		L	L	<u></u>
J'rakê fnir9 eldaT	3		1	3	1 2	3			- î							
ecaT Ining	8			COEF. OF	90	W.					3					
arateCl leinerafil	\$			LAN CANA	8		<u></u>				ļ.					-
obset bbA	8			8	9	5										
Plestic Orthotropic	5			ž	4	6.										
Pleatic Squreet	\$			nob	ani O	¥	۴	ř	\							
ગંત ુલ્માર ભોગ્મ	\$			8	1 2											
Sigortosi	42	X		RATIOS	40											
	+0			2	78											=
	6			Ş	6	-60										
	78			POISEONS	4 5	33										
	8			-	88					~	-	-		-		
L IDENTIFICATION	4 5			uo()	Dine	220	24	ا ا								
1 1	3				2											
i i	1 2			1 3	60	W		-								
2	80	_		MODUL	a	_					-			\neg		\dashv
ğ	6			23	8											
NA.	7 8				5	0										
, E	10			YOU'S	100		\neg					一十				ᅱ
WATERIA	Š				•	6										
*	9				200		ـــا									
	2				eni0	, W	Ē	Z,			_			_		
		2			77	9					Į			ļ	\Box	
]	9 0	240	4	Įų.	100	히		ļ			}			ł		
	8	回	Y.	2	38			l			t			ł	二	
Lock Code	6 3	5	MATERIAL PROVERTIES TABLE	TEMPERATURE	7 8									•		
٠,	20	=	ERI	2										Į		
MATERIAL NUMBER	3		ğ	F	2			ŀ			ŀ	{		ŀ		
12.5	2	一	=		-6			ŀ			Ŀ			ŀ		
ŞŽ	-		Y													
**************************************	0 1	-	TER													
Requies:		二	¥		36	0										
<u></u>					16	ブ										

MATERIAL TAPE INPUT - RECTANGULAR PRISM ELEMENT, CANTILEVER BEAM FIGURE III-B.3

MAGIC STRUCTURAL ANALYSIS SYSTEM INPUT DATA FORMAT

SYSTEM CONTROL INFORMATION

	Commence of the commence of th	
	ENTER APPROPRIATE NUMBER, RIGHT ADJUSTED, IN BOX OPPOSITE APPLICABLE REQUESTS	S YS T E M (/)
1.	Number of System Grid Points	123456
2.	Number of Input Grid Points	7 8 9 10 11 12
3.	Number of Degrees of Freedom/Grid Point	13 14
Ħ.*	Number of Load Conditions	15 16
5.	Number of Initially Displaced Grid Points	17 18 19 20 21 22
6.	Number of Prescribed Displaced Grid Points	23 24 25 26 27 28
7.	Number of Grid Point Axes Transformation Systems	29 30
8.	Number of Elements	31 32 33 3 ¹ 4 35 36
9.	Number of Requests and/or Revisions of Material Tape.	37 38
10.	Number of Input Boundary Condition Points	39 40 41 42 43 44
11.	To For Structure (With Decimal Point)	45 46 47 48 49 50 51 52

FIGURE III-B.4 SYSTEM CONTROL INFORMATION - RECTANGULAR PRISM ELEMENT, CANTILEVER BEAM

MAGIC STRUCTURAL ANALYSIS SYSTEM INPUT DATA FORMAT

1 2 3 4 5 6 COORD (/)

GRIDPOINT COORDINATS

						Γ	~~		-		_			نب D		 ì	R		=-	C		 T			; }	Ń	بنَ ا	 S	-	-	-0-			_		
	(Jrie Nu	Po	រភា មា		Ì		_	<u>۔۔</u> بز			i. R				Ī		_	-	· -								-	_	-		Z	-			
	, 1	9.1	1	. 3	2	1	4	5			-	-	30	. 1	2	23	.4	_		-				1	2	33	.4					•		1	2	
	I		I		1		3				Ĺ			٤		ē	ि	è								5	e	0				$oxed{\mathbb{L}}$				-(1)
Ĺ	1		Ŀ	L			å				_	L	L	L	Ŀ	-	h	Ŀ	9		Ĺ	L			~;	5	•	6	.:	ì		Ĺ	L			1/1
1	1		Ŀ	L		-	2	-	~	_		L	L	L		Ŀ	9	Ě	ŀ	0	Ĺ		Ŀ				٠	_		Ц				ž	j	11
L	1	L	L	Ĺ	*	ķ.,	Ţ-	Τ.	9	_	Ĺ	L	L	L	Ĺ	Ŀ	3	1	٤	0	Ļ	L	Ŀ	L			•	j	Ī	,	Ĺ	Ļ	Ŀ		L	(/)
L	Ļ	Ļ	L	L	,	~	3	,,,,,	_	_	L	Ŀ	L		L	•		E	•		Ŀ					_	ð	٠	ő			L		Ц		1/
L	1	L	L		6		2				Ŀ	L			L	-					Ļ	L		Ц	Ŀ	-	3	c	٩	Ž	انا	L		Ц		(7)
-	-	\downarrow	Ļ	Į.			3	3	E -		<u>.</u>	L	Ĺ	L	L	L	,	7	7-	0	L		L		:	-		3 0		Ц		Ļ	L	Ц	_	17
-	ļ	Ļ	Ļ	ļ.,	•	٠.	2	,		L	L	Ļ	Ļ	L	L	E	4	+~	•	O	L	L			Ĺ		689					Ļ	L	Ш		(7)
-	1	Ļ	Ļ	Ļ	1	-	ŀ	7	Y~	L	L	Ļ	Ļ	Ļ	Ļ		<u>.</u>			L	L	Ļ	Ц		Ļ		•				Ш	L	H	Ц		{/}
-	ļ	1	Ļ	1	₩	•		***	*-	Ļ	Ľ	Ŀ	L	_	L	Albino I	1	400		***	L	L	Ļ		_		٠				Ш	L	L	Ц	_	(7)
-	1	Ļ		1	•	•	ø	·	-	L	Ľ	L	L	L	L	•	_	γ	_	0	L	L,	L	Ĺ			•				ı.	L	L	Ц		17
ļ.	╀	Ļ	Ľ	1	3	1-	•	•	***	L	_	L	L	L	Ĺ	Ŀ	~	13	7	0	_			Ĺ		3	٠				Ш	_	Ц	_		(/
-	1	Ļ	1	μ	7-	~~	ŀ	~	L	L	ļ.,	ļ.,	Ŀ	L	L	_	٥	۳	7 =0		L		Ц			=	Ī	•	•		۰	L	L			(7)
ŀ	\downarrow	╀	╀	•	34		•		L	L	L	L	L	L	L	•	7	←	•	•	L	_	Н	Ц	L	_	3	,	ı	Ц	نا	┞	H		Ш	17
-	1	Ļ	╄		5			,	7-	L	_	Ļ	L	L	L	•	1	•	; —	r	L		Ц	L	L	÷	20	•	_		Ш	L	Н	Н		(/)
-	+	╄	Ļ	ľ	6	Ē	*	0	L	Ļ	L	ļ.,	L	L	Ŀ	=	3	Ų	Ŀ	0	L	L	L			•	73	9	0		Ш	L	L	Ц	_	17
-	+	Ļ	╀	Ļ	L	L	┞	L	L	L	L	L	L	L	L	L	L	ļ.,	L	_	L	ļ.,	÷	i	Ц	Ŀ	-1	L		Н	Ц	┡	H	Н	Ц	(/
-	Ļ	╀	┡	Ļ	L	Ļ	-	L	L	L	H	L	L	L	L	L	L	L	-	_	_	_	Н	L	Н	Ļ	_	Щ	_			L	H	Н	-	17
ŀ	+	╀	╄	┞	-	Ļ	╀	-	H	H		-	L	-	L	L	L	Ļ	Ļ	L	L	H	Ш	Н		L	,	H	Н		_	-	Н	Н		1/
-	+	 	╀	╀	┞	Ļ	L	L	L	-	-	ļ.,	L	ļ	L	-	L	L	┡	L	L	-	Н	H	-	Ĺ	H	H	_	Н	Н	-	H	Н		:/
-	+	╀	╀	╀	-	H	┞	H	L	-	\vdash	Ļ	Ļ	-	-	ļ	-	H	\vdash	H	-	L	H	Н	H	H	H	Н	Н	-	Н	_	Н	H	Н	(/
-	+	╁	-	 	H	 -	-	H	-	H	-	-	H	-	H	-	┞	\vdash	┞	H	L	Н	Н	Н	Н	_		H	Н	_		-	H	Н	H	(/
-	+	+	╀	+	-	+	╀	H	-	H	H	\vdash	-	┞	\vdash	H	-	-	-	-	H	\vdash	\dashv	Н	Н	H	H	Н	Н	Н	Н	-	Н	Ц	\vdash	(/
H	+	+	╁	┞	┞	 -	┝	H	_	-	H	F	\vdash	-	H	Ļ	-	H	┞	H	-	_	-	Н	H	1	Щ	Н	_	**	H	-	H	-	\vdash	17
+	╀	╀	╀	+	-	┞	┞	-	-	۲	-	ŀ	-	L	-	-	-	╀	-	μ	H	H	Н	Н	Ĺ	L	_	H	Н	Ц	Н	H	H	Н	H	(/
-	ŧ	ŀ	+	H	-	┝	┞	H	-	-	-	H	-	H	H	H	H	┝	1	Н	L	H	Н	Н	H	Ŀ	H	Н	Н	_	H	-	Н	Н		(/
-	+	╀	╀	Ł	-	1	╀	-	\vdash	-	<u> </u>	ŀ	H	Ŀ	H	L	ŀ	-	-	H	-	H	H	H	H	-	<u>.</u>	Н	Ц	Н	H	-	H	Н	\vdash	1/
+	+	╁	╁	╀	-	H	}	-	-	┝	H	-	-	-	-	L	-	-	-	Н	H	÷	Н	Н	Н	Ļ		H		H	H	-	Н	H	H	(/)
L	L	Į.	L	L	!	L	L	L	L	L	Ĺ	L	L	L	L	L	L	L	L	L	Ļ	ليا	Ш				Ш		Ù			L		IJ		111

FIGURE III-B.5 GRID POINT COORDINATES - RECTANGULAR PRISM ELEMENT, CANTILEVER BEAM 171

MAGIC STRUCTURAL ANALYSIS: SYSTEM-INPUT DATA: FORMAT

BOUNDARY CONDITIONS

INPUT CODE - 0 - No Displacement Allowed 1 - Unknown Displacement 2 - Known Displacement

PRE-SET MODE

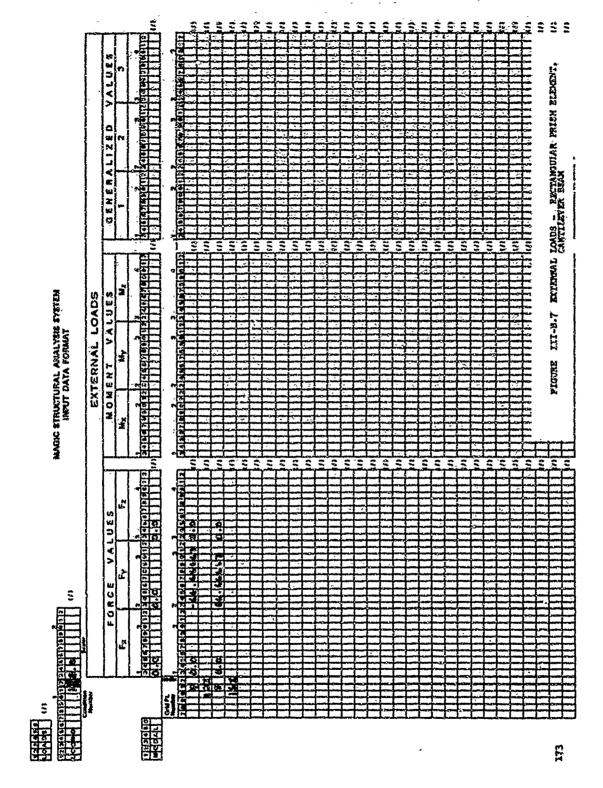
	-					
Ì	à	2	3	4	H	6
į		7		2		
1	54	٥	٦	٩	ŕ	

	TŖA	NSLAT	IONS	RO	TATIC	NS	ĠĘI	VERAL	ÎŽEO
,,,	υ	٧	W:	Çx.	ØŶ	6z	1 -	3:	3
,	.13	14	18	15	_17	18	19	20	21
Ž	2		1	, ,	,		.,	,	

LISTED INPUT

7	ŝ	9	5	3	1	. 13	14	15	18	17	18,	38	20	21
-				į	П	0	(3)	C						,
-		Ī	F		X				7	-			122 4	
		T	,	-	X						· · · · ·			
_	r	1	ger.	•	X					·	:			
		H	۲	ř							,			
	r	1	T											
_	l	† ,	T	۲			·				,		-	
	۲	۲		1	Н		,	, , , , , , , , , , , , , , , , , , ,					-	
-		T		-										
	H	H	-	H	-					-		· · ·		,
,	۲	t	-	-										
•	r	T	r		H									
_	┝	╁	1	H	H	,								
-	r	T	T	H							,			
-	r	t	١,	İ										
-	l	t	۲	H									,	
-	ŀ	t	+	1	H		 	 	· · · ·					
	1	۲	十	۲	H	,			-					
-	-	t	t	一						-				
,	-	t	+	H	H	-		-	-					
	H	┝	+	-	Н		ļ							

F1 PURE III-B.6 BOUNDARY CONDITIONS - RECTANGULAR PRISM ELEMENT, CANTILEVER BEAM 172



BAC 1627

-	-			_	_	-			<u>.</u> =	تستو				<u>۔</u>		~			٠				
	-	ýminos	-	3	Σ	<u>2</u>	5	<u>S</u>	$\overline{\mathbb{S}}$	Ξ.	3	<u> </u>	2	<u>.S</u>	3	3	\mathfrak{S}	<u> </u>	\mathbb{Z}	<u>2</u>	S	2	<u>S</u>
-	Ì.,	7	20	<u> </u>			<u> </u>	 			1		_		-	-	 	-	-	-	است	-	\vdash
	•	بنست.	Ģ		-	-	-		-		بَ	Į.			<u> </u>								
		2	*	3	}	ار ب		 -	-	 -		-	 -	جما	-	<u> -</u>	-	 	<u> </u>	 	-	Ļ	
•			9	<u> </u>															-				
:		6		-		12.2	<u> </u>	٠	<u> </u>	┞	ļ.,		-			-	ئي ا	سنج		ļ			
		2	. 17		<u> </u>	E						È	ئىس ئىز	-									
			12		1	10.00	<u> </u>	-	<u> </u>					1	-	Ţ		<u> </u>			-		
₫.	_		*0				_				_		-	-	Ĥ			-	-	-	 -		
# # # # # # # # # # # # # # # # # # #	*		3	8	O	F				ļ.,													
3			- K		1 40		-	 	-	ļ	-	- 27	-		-	-	-	-	-	-	-		
	_	S. Contractor	æ		1	M			2	-				-									-con-
•	0	_	-	-		-	-	<u> </u>	-	-	-	13	-			÷	<u> </u>	<u> </u>					
95. See		*	(0)		3	-			<u>~</u> ^							_	~~						
*		*	~~	-				Ĩ	5.3	-			<u> </u>		<u> </u>				٠,٠				
1 0 X 1 X 0 0		i di periodi	\$ 20 00	Ē	=	Ð	<u> </u>					خيب					-			-		منت	<u></u>
		** **								بي ا	Į		· ·		-					Ļ			П
4	0	خبنمين		দ		-	-		بنبإ	1	-	خند	<u> </u>		ž	ļ	٠.		-	·	-		
185 1 11	Ž.	.	4		-			-									٠,						
			25	-	Q	- 0		-		-	-	ببنا	ļ.	_	-	L		-			شم	-	
ŭ		- 679	m		**			ئىسىيە شەرا	-				-	-			1	-		 	-	-	
			± 25	त	7			- 2	<u> </u>										ž.				
		á Ì	60		**	. e 6									-	-	-	-				 	
				-						-	-	_		332					_		_	-	
3		•	7.		-	7			-	-	-	-			-	-							
SYSTEM	أسيأ		5 7				-	-															
	7000	A M. 6% Best	R			. v								Ϊ,		,	1	٠					
ANALYSIS	Tacar.	vedosh Maral	5.4	90	68	8	-							_									
3.5		(19)	8	-			-	_		-			-	-		-	-	-	-	-			
2 9		-				-				<u></u>				_						L.,			
₹ ∢	PRIMY	. MALE	á					l		Ĺ	_						,			- :			
33	2	क्रिक्	8				,			,				-			,	,					
50		Elen. 100	-		ن نکع	× 4									<u> </u>		-		-		-		
STRUCTURAL ANALYSIS INPUT DATA FORMAT		لسند	. 75	X	×	×	·			-													
K Z	\$4 210072	toses A ehtaid	88													`		٠,	ľ				
70			1									-						<u>.</u>	L				
MAGIC		SECONDARY TURE	67	-									-	<u> </u>			-						
*	¥	2	123466						Ť														二
₹•	` *	4	¥				- į		<u> </u>		_	H	 	 	 				 		 -		
	1	A.	2														-						
	Š	2	22		<u>.</u>										<u> </u>			÷					二
		61160			64	•	-				_	,			_	,		******			-		
	619	(4619fa)	-	119		-					-	-					-		—				
	MATERIAL.	2	87.5										<u> </u>										
	, a	RUMBER	33		,,,,,			- Same		750							Į.	٠					
	-	5	9		-				-			-											
S	2		3		Ĭ.																		二
38.4	,OK	อกาส	1 2	3	G	Q.]							-									
30	Constitute.		16		S	Š																	
3 %	10	36145M 361372	8	-		_									<u> </u>				-				
			7 8						•														

では、これでは、10mmのでは、10m

ELEMENT CONTROL DATA - RECTANGULAR PRISM ELEMENT, CANTILLEVER BEAM FIGURE III-B.8

	:	سخ	N.			- A	<u>, </u>			بت				9	النتب			7	لنسبا	1. 4	T-0-71	1
		1			. [0.1.2					سبيد		مشمس				-î-	بتنشا	<u> </u>			بستي
		1	~ 0		i	~ 0	-		-							_		4		-		
			•] .	-			بستا				·	3.1	7	-	بيت	-	ببب			
		1		≔ -{	- 1	(A)	-			إحسنا	ئىسنا	\vdash		حتث	2	-		لننب		-		
		ш			I		_		ļ			ننت			<u> </u>		سنب	أخنا	بنب			
	=	!	F		- 1			ننا			<u> </u>			<u>`</u>	-	ــــــــــــــــــــــــــــــــــــــ		-	£.	<u> </u>		
		Į. Į	ြေ	ر قر	1							ائند		<u>. </u>			, ,	أشتنا	1	النا		
	j	1	10	<i>,</i>	- 1	jo.	-2:	, ",					3	ŭ,	ا ــــــــــــــــــــــــــــــــــــ					. ``		
		7	* ₹	7	- 1	6 55	,	7	* * *	1				•			,			-		·
			90	_	- <u>I</u>	. 60		7					. "									
	:		~		Г	27			7.								•	1		- 2		
		1	-	-1.	ı	-		-	-		-			13						7	إسنت	
					1.	60	-	<u> </u>		,	-	-	٠٠٠			, ,		200		1		
		1	#O		- 1	0		جب		<u> </u>		اسنا				———			اجب		,	
	7	1			ı				-	1				<u>``</u>	بينا	-						
	ಹ	w	*-		- 1	**	احب	ئيث			سيسا	~		احت	<u> </u>	كنيا	٠	سيب	 			<u> </u>
	Z					۶	اب		<u></u>					<u> </u>	المشا				ننيا		است	أسنب
	~	ìi	*6		- 1	43		-			_	2				```	3.1	لببيا	-	-		
	5	ı	10	!	- 1	*87						. v .					; : : ·	لتثا		أخسأ		
	1		₹.		- [*			ائسا				, `	٠,		- 2	1		7	<u> </u>		. أــــــــــــــــــــــــــــــــــــ
	2	Ш	100		Ŀ	2 3 4 8						- /							Ť.			
	m.		.'U			7		,				```			·		•••				' ت	
	ELEMENT INPUT		-		ł	**		·					·			-1	٠, ٠					
			60		Ì	16 O		•											- 1			
			0			45 C		-									15.	/	2.5			
Æ		۵			I	8					, i	,	,		Ţ	(•	- ~				
MAGIC STRUCTURAL ANALYSIS SYSTEM INPUT DATA FORMAT		"	~		i	7			-													
Ę		1	3 0		1	•			 		٠									/ -	 	
<u>g</u>			<u>"</u>			16	 			ابب				<u> </u>		·	-		أجيز			
5			4		1	*	 	-					,	h								
69.			96	{	ì	90			-	-			-									
TRUCTURAL ANALYSIS INPUT DATA FORMAT		-	77		۲	7		-		<u> </u>		<u> </u>			-	-		<u> </u>			·	
5 3	İ				Į			<u> </u>					-		-							
닐줊			40		- 1	40			-						-							
\$5		l	1		- 1		ļ		-	-	<u> </u>			-								
2 L		ı			j	a			-		,									-		
. ∢		U	- Ε			40				<u> </u>				 					 			
2 5			l rL	l	Î	~																
₹ \$		1	6		- 1	€)																
₽			105		ļ	10																
55			*		- {	7					·								ž			
3 だ			იი		L	8 8																
Œ Z			7		- [•												
5		1	-		- 1	**																
•		1	60		- 1	no			,													
ဋ		1	∞		- 1	33																
9			æ	7	ł	•																
4		80	~	_	- [100										~~						
45		1	5	-	į.	40		ļ	-													
			- a		1	8										-				 		
			, ,-		ı	up.		 -				-			<u></u>		 		 			
		1	7							 -			 -		 			 	 		,	
		-			Ļ	80	-	 -		 		-		-		 	 		 	 	 	—
			~		į	- 44	 	 -	ļ	 -	┷	 				 			 			
					I	•				ļ				 		 	-	 	 	 		
			70		ı	40			ļ	 _	L		<u> </u>									
			o_		- 1	•			<u> </u>						L	لـــا						
		ر ا			ı	•																
		٩	~			-																
		1	v		ì	•			I													
			* T	Q	1	10																
			4	•	I	*					T											
		L	-6	٥		~6																
				120	SH	~																
					7			-	_													
				1 3	: 41	-0			 -						<u> </u>		-			 	ļ	
	_			1 1			 							-				 	 		-	
	S			13	Z Cart	3	<u> </u>			<u></u>		<u></u>	 _							 		
	-			- I. "	-	7 8		 	3 - 50			 			-		 	 	<u></u>		اسسا	
_ r	2 0	1	9		ائب					ا		-	L	لنسبا				لسبا	أسننسا	لنسا		تئسسا
BAC 1528-1	1 2 3 4 6	: :		M O O A L						:	175											
Ċ	w -		-	Z																		

55555

ELEMENT INPUT - .ECTANGULAR PRISM ELEMENT, CANTILEVER BEAM FIGURE III-B.9

MAGIC STRUCTURAL ANALYSIS SYSTEM INPUT DATA FORMAT

CHECK OR END CARD



FIGURE III-B.10 END CARD - RECTANGULAR PRISM ELEMENT, CANTILEVER BEAM

SINSTAUCTION SOURCE

TICS AGENOUM, MITH CCMOENSITERN STATICS INSTRUCTION SECUENCE E 6 8 8 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9	0550 M3046 -	AGENDSS1 AGENDSS2	* * * * * * * * * * * * * * * * * * *	A6630395 A6520395	CANODADA CANODADA	A6060340	ACCIDENCE OF CAMPAGE AND CAMPA	AGEN 0363	46646364	ACEMO363 ARBEO366	ACIN 0367	ACCUSTA	ASENDITO	AGE 2007 2	ACCUSANOSTA ACCUSANOSTA	AGENOSTA	ACEMBIA!	ASSOCIATION	ACCURDO A		A66203002	のからのおおける。	AGENOSES	のの作品を記する	10000000000000000000000000000000000000	ACTUAL CUSTO	AGENOSOS	ACCHOUGH	
STATICS AGENCIM, MITH CCAN STATICS INSTRUCTION SEG GENERATE ELEMENT MATRIC OFFERMINE PRINT FORMY IL NO. TOON TO WELFEL STENGLE STIFFNESS MATR MO. MO. MELA. SC. (10) FTELA = EN .ASSEN. SC. (10) FTELA = EN .ASSEN. SC. (10) FTELA = EN .ASSEN. SC. (10) FTELA = EN .ASSEN. SC. (10) FTELA = EN .ASSEN. SC. (10) FTELA = EN .ASSEN. SC. (10) FTELA = EN .ASSEN. SC. (10) FTELA = EN .ASSEN. SC. (10) FTELA = EN .ASSEN. SC. (10) FTELA = EN .ASSEN. SC. (10) FTELA = EN .ASSEN. SC. (10) FTELA = EN .ASSEN. SC. (10) FTELA = EN .ASSEN. SC. (10) FTELA SC.	•	LENCE	* * * * *	3 0€	, 1	11 NUEL HATRICES	TYPE OF FEERENES US			ELENENT			AND PRINT		C (5 e1 % o)		CETCHE	(1, 1)	LCADS	O CROCRED SYSTEM, FORM TOTAL LOADS	SS FATBLE		C (8,1) 0)	And State of the S			K1211		
	STATICS AGENDUM, MITH CCMD	INSTRUCTION	* * * *	GENERATE ELEHENT MATRIC		ER X 11 UNIT 480	DETERMINE PRINT FORMAT	I I SMEL SC	II . SHUE T.		F. F.R.	A = EN .A SSER	REDUCE STIFFNESS MATRIX		KCO-STEFF - KNO-DEJOIN. (D PRINTEDECF, DERF STEFF		REDUCED, TOTAL	OJX a	MALTIPLY ELEMENT APPLIES	TRANSFORM EXTERNAL LOADS T	***			- Rosb . DE JOSK.	SE EXTERNAL LOAD C		(K11 -	= -K22	

PIGURE III-B.11 MAGIC ABSTRACTION INSTRUCTION LISTING .. RECTANGULAR PRIGHT, CANTILEYER BEAM

```
ACEN 0399 9
ACEN 0399 9
ACEN 0399 9
ACEN 0399 9
ACEN 0399 9
ACEN 0399 9
ACEN 0399 9
ACEN 0399 9
ACEN 0401 1
ACEN 0401 1
ACEN 0401 1
ACEN 0401 1
ACEN 0401 1
ACEN 0401 1
ACEN 0401 1
ACEN 0401 1
ACEN 0401 1
ACEN 0401 1
ACEN 0401 1
ACEN 0401 1
ACEN 0401 1
ACEN 0401 1
ACEN 0401 1
ACEN 0401 1
ACEN 0401 1
ACEN 0401 1
ACEN 0401 1
ACEN 0401 1
ACEN 0401 1
ACEN 0401 1
ACEN 0401 1
ACEN 0401 1
ACEN 0401 1
ACEN 0401 1
ACEN 0401 1
ACEN 0401 1
ACEN 0401 1
ACEN 0401 1
ACEN 0401 1
ACEN 0401 1
ACEN 0401 1
ACEN 0401 1
ACEN 0401 1
ACEN 0401 1
ACEN 0401 1
ACEN 0401 1
ACEN 0401 1
ACEN 0401 1
ACEN 0401 1
ACEN 0401 1
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             print element applied loads. Exterbal loads. Desplacements. Rections and inverse check in emsineexing format
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            CPR INTE 40 00 FT 0 0 FT 20 0 FT 20 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 FT 0 0 F
                                                KR = KIL -ADD+ KRZ

TRIA-DI = KR.PL -CHIRIA-

SOLVE FOR DISPLACEMENTS DI

DZ = WRL -MULT. DI

DZ = VRR - MR.PP-

DZ = DI -ADJOH, D2T.

KR = DI -ADJOH, D2T.

KR = DI -ADJOH, D2T.

KR = DI -ADJOH, D2T.

KR = DI -ADJOH, D2T.

KR = DI -ADJOH, D2T.

KR = DI -ADJOH, D2T.

KR = DI -ADJOH, D2T.

KR = DI -ADJOH, D2T.

KR = DI -ADJOH, D2T.

KR = DI -ADJOH, D2T.

KR = DI -ADJOH, D2T.

KR = DI -ADJOH, D2T.

KR = DI -ADJOH, D2T.

KR = DI -ADJOH, D2T.

KR = DI -ADJOH, D2T.

KR = DI -ADJOH, D2T.

KR = DI -ADJOH, D2T.

KR = DI -ADJOH, D2T.

KR = DI -ADJOH, D2T.

KR = DI -ADJOH, D2T.

KR = DI -ADJOH, D2T.

KR = DI -ADJOH, D2T.

KR = DI -ADJOH, D2T.

KR = DI -ADJOH, D2T.

KR = DI -ADJOH, D2T.

KR = DI -ADJOH, D2T.

KR = DI -ADJOH, D2T.

KR = DI -ADJOH, D2T.

KR = DI -ADJOH, D2T.

KR = DI -ADJOH, D2T.

KR = DI -ADJOH, D2T.

KR = DI -ADJOH, D2T.

KR = DI -ADJOH, D2T.

KR = DI -ADJOH, D2T.

KR = DI -ADJOH, D2T.

KR = DI -ADJOH, D2T.

KR = DI -ADJOH, D2T.

KR = DI -ADJOH, D2T.

KR = DI -ADJOH, D2T.

KR = DI -ADJOH, D2T.

KR = DI -ADJOH, D2T.

KR = DI -ADJOH, D2T.

KR = DI -ADJOH, D2T.

KR = DI -ADJOH, D2T.

KR = DI -ADJOH, D2T.

KR = DI -ADJOH, D2T.

KR = DI -ADJOH, D2T.

KR = DI -ADJOH, D2T.

KR = DI -ADJOH, D2T.

KR = DI -ADJOH, D2T.

KR = DI -ADJOH, D2T.

KR = DI -ADJOH, D2T.

KR = DI -ADJOH, D2T.

KR = DI -ADJOH, D2T.

KR = DI -ADJOH, D2T.

KR = DI -ADJOH, D2T.

KR = DI -ADJOH, D2T.

KR = DI -ADJOH, D2T.

KR = DI -ADJOH, D2T.

KR = DI -ADJOH, D2T.

KR = DI -ADJOH, D2T.

KR = DI -ADJOH, D2T.

KR = DI -ADJOH, D2T.

KR = DI -ADJOH, D2T.

KR = DI -ADJOH, D2T.

KR = DI -ADJOH, D2T.

KR = DI -ADJOH, D2T.

KR = DI -ADJOH, D2T.

KR = DI -ADJOH, D2T.

KR = DI -ADJOH, D2T.

KR = DI -ADJOH, D2T.

KR = DI -ADJOH, D2T.

KR = DI -ADJOH, D2T.

KR = DI -ADJOH, D2T.

KR = DI -ADJOH, D2T.

KR = DI -ADJOH, D2T.

KR = DI -ADJOH, D2T.

KR = DI -ADJOH, D2T.

KR = DI -ADJOH, D2T.

KR = DI -ADJOH, D2T.

KR = DI -ADJOH, D2T.

KR = DI -ADJOH, D2T.

KR = DI -ADJOH, D2T.

KR = DI -ADJOH, D2T.

KR = DI -ADJOH, D2T.

KR = DI -ADJOH, D2T.

KR = DI -ADJOH, D2T
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          8
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   CPR INTE 400F KOF VOF ZONE NY DE SCOTA PFTELA
CPR INTE 400F KOF VOF ZONE NY BRZ 65C 3 14 CADS
CPR INTE 2006 VOW, THE TAX, THE TAY THE TAX 65C 9 IN
CPR INTE 200 FX 0F YOF ZONE NY 64 SCOTA PREACT F
RF (13. MALL.) GO TO 600
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           ELEMENTS HAVE I OR 2 DEGREES OF FREEDOM
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          Calculate reactions and tayerse check
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        elearnts have a degrees of preeden
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    GENERATE STRESSES AND FORCES
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 EM. XO . STRE SS. (4.)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               REACTS # KELA.MLL.XO
REACTP * REACTS.SIBT.TLOAD
IF (DIFF.NULL.) GG TG 10
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             = TR12-THULT-XX
) = TR.HLT-X
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          . .
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 STRESP
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          8
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            200 A
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     なるなるの
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              34 44
44 44
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          $ P
                                                                                                                                                      2
                                                                                                                                                                                                                                                   24
                                                                                                                                                                                                                                                                                                                                                2222
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                222
```

FIGURE III-B.11 MAGIC ABSTRACTION INSTRUCTION LISTING - RECTANTULAR PRISM ELEMENT, CANTILEVER BEAM (CONCLUDED)

STATICS ANALYSIS CCHCENFRATED LOADS EQUIVALENT TO MORENY THREE ELENCAT CARTILEVERSO DEAM SUBJECTED TO AN BID REVISIONS OF NATERIAL TAPE MOMENT. RECTANGULAR PRISO ELEMENT IDEM. NO.52

was a complete to a second or and the second

ASTERISC (4) PRECREDING RATERIAL LOCATIFICATION (HDICATES) 1941 TAPLIT CRECK RESULT IN TERMINALION OF ENECUTION

INAUT CODE . Q. 733949948-03 MATERIAL HUNGER
NATERIAL SUENTIFICATION STEEL
NUMBER OF RATERIAL PROPERTY POINTS.
WINBER OF PLASTIC PROFERTY POINTS. MASS DENSITY. MATERIAL PROPERTIES MEVES ION 179

MOUSE'S MOULE

FOISSON'S RATIOS

AX & 333000E 00 2x 0.122528E 09 od Schores of 42 38238 98 6, 112528 98 DIR OF THOMS DIRECTIONS 0.333000E 80 C. 112528E CO RIGIOTTY ROCK! 22 0.30000000 2.2 0.690000E-05 7.4 C-300000E 08 6. 690000E-05 OI RECTIONS DE RECTEONS The EXP.COEF. XX 0.30900E 08 20-3063629°C TEMPERATURE Tenpesature 9.0 0

ÉIGURE III-B.12 TIILE AND MATERIAL DATA OUTPUT - RECTANGULAR PRISM ELEMENT, CANTILEVER BEAM

《李子李子》

NO. DIRECTIONS - 3 NO. DEGREES OF FREEDOM - 1

GREGORINT DATA

PRESSURES																																					
;	90	9 6 6		Q (0	0.0	9	9	9 6		0.0	000	9 6	9 6	9 8	0	0.0	6	000		9	9	0,0	0.0	0	000) (ě	0	G	Ģ.	e e	000	9	e e		9
TEMPERATURES	D & 6	200	9 O	\$	3 5 5 5	0.0	\$ (90 (B	2 °	2 9	0,0	0.0	000		96	O _c	0.0	0.0	0.0	D 6	9 0	000	0.0	0.0	0.0	0 (200	0	0.0	0	9,0	96	3 9	8	2 ×	\$ @ \$ @
	~ ∂	10		10		10:			70		10			5		10			70		20			10:					40			7		40		•	# 3
*	2000C	0.3000000E	1	0.30000000 E		0.30000000E		9000	20000		100000		2000			300000			0.30000088E		2-3 0000000E			0.30000000E		300000000			300000			2000		00000			
	0000	0.300		80 e 30		0.380			-0-300000000		-0.39000000E					-0.3 KD00000E			0.300		0-300			0.300					-0.3000000E-0-		•	-0-3000000E		300000000		4	30000 000 CO
		70		Ø		8					10			¥		8					ã			8		3						5		7			3
•	3 3	- 4. 70000000E		-0-14000000		- 0.21060400E			3		C. 70000000C			308200+T-0-		- 6.21.9059005			98		-6.70000000			-C.140000E		3000000	300000000000000000000000000000000000000		94		1	~ C. 700000000		-C.14 00(1300E			
;	ត ត	5		5		50		;	10		10		;	ž		5			6		Š	;		10		ĕ	Š		5			3		ž	}	•	5
×	-0°28898900E	-9.20000000E		-0°200000000		-0.2000000			-0.20000000		-0.2090000E			30000000000000000000000000000000000000		-0.200000Œ			0.2848090CE		0.20000000E			0.20000000E		5000000 C			0.2000000E		1	0.2550000E		6.20000000			333345667°6
FOINT	nci	N	•	~		•		•	r		•		•	1	.80	•	ı		•		9	:		=		:	4		A	ı		*		15	}	3	2

FIGURE III-B.13 GRID POINT DATA GUTFUT - RECTANGULAR PRISY ELEMENT, CARTILEVER TOWN

SOM	
w 0	K m O A A B d B B B B B B B B B B B B B B B B
HO. OF THOS	
HO. OF OMES	0 N + 4 4 8 0 N N Y 4 8 8 9 0 N Y Y
5	
NG.	
Recrees of Pacedon	
RECASE	किल में में किला में भी किला में भी किला में भी किला में
	ં ભે મે સે સે સે ખે ના ના ના છે તો માં માં માં છે નો માં
	◆にダボ⊕がぶめ⇒☆ががほどだめ
83008 8	· 医鼠窝宫宫宫宫 · 医白色白色色色色色色色色色色色色色色色色色色色色色色色色色色色色色色色色色

Total Do. Rieneues ==

MC TES	
į	144
EXTRA GRED PTS	
	en p
2	
1005	9 E
2	12 E3
9.46	22
7	M
ę oz	· m #
¥ .	***
PERT.	66
	9 0
Z C	
MAT JAG.	i es i esi
2 8	N. C.
10 4	MM

FIGURE III-B.14 BOUNDARY CONDITION AND FINITE ELEMENT DESCRIPTION CUTEUT -

ELEPENT LCAS SCALAR - 0-0

LOUIS 40°

77	44	144	44	4	9 9	₩ 20 3 d:	0 0 0 J J	5 4
-		2 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
OF LOADS	20.01		* 0	60	90	**		
SEPTEMBER OF								
3	44	34	6.5	34	00	9.4	5 d	
					4 p			

extensal load conditions - rectangular trien Element, cartillerer been Verestored extensal assemble loas colum PICORE III-8.15

		2 × 8			
9.0	6. 0	5.6	6.9	**	ğ
***		6-6		· 6.6666666 65.	ş
# * 0	Ø. Ø	0.0		***	8
0.0	• 0	0.0		S. S. S. S. S. S. S. S. S. S. S. S. S. S	•
•	9.6	6.8		9.0	3
**	9.9	**		** \$5.646.2596at 62	į
B. B.	6 ° 9	8.6	~	***	3
8°*	6 .0	6.3		G. 5466-698R EE	4

\$-2590 FOR STAUCHUR. - 8.4

TRANSPORMED EXTERNAL ASSEMBLED LAND OUTFOT - RECTANDULAR PRISK ELEMENT, CANTILEVER HEAM PIGURE III-B.16

		553	2882	2 4322	288388	8 88 888	3833 36 3
		-	-	-		*	
		-0, 819605E -0, 104029E 0, 148459E	-0, 1122035 -0, 3428908 -0, 1304466 0, 4826848	3726468 3123038 1664238 5619868	0.1392966 -6.1893896 -0.2894986 -6.1937986 -6.19486 -0.92648	-0. 48.90.988 -0. 18.20.8.78 -0. 18.20.8.78 -0. 18.20.8.88 -0. 20.88.90 -0. 6.52.48.88	-6.7629916 -0.3963226 0.3622756 0.1334016 0.1334016 -0.326468
			4 4 4 4	5 6 6 6 6 6 6 6 6	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	1467 4460 # 244 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	900 0000 ENS BUNK
		0 55	ရဲ့ ရုံရုံင	သိ ရှိ ရှိ ရန်	44440	ငံ့ နှင့်ပံ ဝ ခု နှင့်	777
	FORCE	0 4 N	6 0 0 10 N N N	4 11 18 18 18 18 18 18 18 18 18 18 18 18	4 N8444	**************************************	**************************************
*	2	77 @ 00 0	2000	77#77 80000	744404		
8		0,16569M 0,18642M -0,276634W	-0.1919335 -0.3881446 -0.3823556 0.3930415	-0-7639938 -0-8384638 -0-8346638 -0-4683138 -6-246634	-0.3328445 -0.8333038 -0.84333 -0.8433145 -6.3383465 -0.33843465	-0.11290# -0.27963# -0.27963# -0.27963# -0.2067102# -0.10148# -0.3246# -0.3246# -0.3246#	0.721646 6.5815146 0.594269 0.3101799 0.3262499 0.3262499
2		0 K 0 K 0 K 0 K 0 K 0 K 0 K 0 K 0 K 0 K	0.2929 0.28824 0.3824 0.3824 0.3930	9 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2		
		0 00	6 9 5 5	7 7 7 7 9	7777	Proof cont	
3715	FORCE	964	0 9 9 8 8 1 1 1 1	0 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	医夏尔克贝尔	STANDS SOURS	**************************************
•	8	586	3 8 3 8	22233 22233	82838	7878 C C C C C C C C C C C C C C C C C C	797 g 77 g
				0 0 0 0 0 0 0	**************************************		## ## ################################
		¥ 35	¥ 17 17 17 17 17 17 17 17 17 17 17 17 17	22222			
		0.3720446 0.1346626 0.559269E	6.139296 E -0.156423E -0.326240E	0.7216906 0.855616 0.355638 0.164638 8.2796346	0.135.4384 0.135.4328 0.135.4328 0.136.2368 0.136.2368 0.136.2368 0.136.2368 0.136.2368	60000000000000000000000000000000000000	0.112303 -0.2021233 -0.103126 0.5013166 0.900666
		6 9 9	ထင်စုခ	ဝဝခုန္ အဖ	G 6 G G G	endod Adada	944 4004
	FORCE	4 28	4 2 B Z	中中教育政治	* 22253	adur adur	4 2 8 4 2 N N
	Œ	523	2000	33333	445546	00222	0000 000
		-0,763941E -0,330632E -0,563514E	-0.372846E 0.133463E -6.130374E 4.130396E	-6.1728688 -6.132938 -6.134238 -6.5613188 -4.55929	0.1342/46 -0.1863/46 -0.1863/46 -0.393618 -0.393618 -0.393618	-0.372346 0.429676 0.559346 0.559346 0.559346 0.559346 0.667346 0.667346 0.667346 0.667346	-0.014005 -0.106023E -0.106423E -0.342893E -0.342890E -0.343061E
		200	200				
0.0		777	9090	400044	- 1111	1-1-1	
Ó	CORCE	កក្កស្ល	m 122	N - 2 2 2 2 3	~ @ # 2 # # 9	· 医肾病毒 · 医鼠虫毒毒	n 22 n 227
# !!	ă.	2238	2355	822322	833333	58588 58585	228 8823
cuta							
ü		e. 7216998 - 6. 11.23 036 - 6. 9021 138 6. 8422 758	0, 6143 646 - 0, 1051 346 - 0, 32615 166 - 0, 3262 466	- 0, 763951E - 0, 619562E - 0, 13662E 0, 997269E 0, 997269E	0.3728468 0.1129098 0.185438 0.5613168 -0.5813168 -0.326268 0.363088	-0.4639438 -0.1323438 -0.1453148 -0.1864238 -0.3723468 -0.2734348 -0.3262448	0.183001E -0.3725048E -0.135048E 0.18543E 0.133246 0.133246
		2 1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	5 2 8 8	* 5 2 3 3 3 3 3 3 3 3 3 3			
		9 000	111	1111	9 992 992		
	Race	- 248	~ ១ភូនិ	4 - 2022	- Passan	72527 7252	- 2 7 2 7 2 7 2 7 2 7 2 7 2 7 2 7 2 7 2
	K	***	a	eA.	*	5 1	fn •
		_			183	A	
		820	9220		• 105 #		9 81 0 9 81 0

PIGURE III-B.17 STIFFMESS MATRIX - RECTANGUIAR FRISM ELEMENT, CANTILEVER BEAM

		-	38				-	-	_	_	8	-		B	-	_	-		-		6	-		b	_	6		_	-	8		6					25	8	
		o d	-0. 3728486 0. 6414166	-0.186423E	Ó		-0.105134E	0.137296	-0.103796	-0.28814#E	0.3930616	~ 0, 32624 dE		-0.769941E		-0. 165526E	0. 14845 SK		-0.372844E	C. 263 744E	Q. 261316E	0. 198531E		- 6. 902313E	0.185367	0. 95 926 SE		-6. 541 51 6E	-6. 291933E	日本のなるので	U. ATTERECTO	0. 1664235	-0. 562526E	Ó (Section And Section 1	74.534284 10.534284	~0.200148E	-0-101798E	! ! !
	FORCE	•	2	,	* ##3 \$ 8 9		٠	32		26	8	4		₹	\$	23	e G		o	4	. (4)	8		₽	\$	35		æ	20	9 (n M	•	(4 m	0	Ÿ.	ñ	•	C.	1
*	<u>u.</u>	62	50		6		90	r	6	20	5	5		20	<u>بر</u> ق	6	10	6	90	6	6	03	G	3	5	5		38	9	6	9	0	20	Q (Ø (9	60	63	, ,
30 QA		-0.619409	-0,763591E	-0-10461X	-0.5892696		0-11230X	0.3728466	0.541516	0-1556236	0.902654E	-0.982854E		-0.372846E	-0.902113E	0.186422	3926	-0.5542646	-0-14996TE	A SANGE OF	-0-2691495	0.952654	-0.6524816	-8-104023	O. 27284.6F	-0.042775		-0.4424-0E	3929	-0.32624GE	9 9 7	-0.134662E	-0.502113E	-0.75 Webs	•	-0°84221%	-0.18642 X	-6.44151 AF	
3715	FORCE	AC)		- 6	10)	n	o 4		. 6	8	PA PA		•	<u>د</u>	22	53	S	Ø	*	200	S.	*	•		62		6 2	9	26	4	80	eri cot	7	P)	e M	es.	-	9 i
	•	385401E	0.721690E 08				-0.201933E 03	. PISTRAE	2000 E	3.44.2	0-326240F 07	343041E		0.929007E 07	0.112303E 08	-0.13666ZE 08	0.842275E 07	-0.168455E 08	0.372866E 07	3681600	-0. IRSA73F GT		.326249E	O TREADUR OF	7430016	-0.168455F 06		-6.238149E 07	772846E		82654E	-0.330032E 07	ш	721690E		0.642275E 07 0.279634E 07	0.1334415 07	34.2840 %	
	FORCE	M	• 1	១៖	1 5	8	•	2	3	3 8	in	×		en.	2	ដ	R	×	*	2	3 8	R	12	•	,	3 (2		*	22	R	×	ri)	•	ង	7	裁裁	*	•	ì
	-		6				9					6			8	_	6		G		9 G	6	g		•	5 0		6	_	8		ò	-			35	07		
•		-0.112303E	0-372846E	-0.561580E	16186423E	-0.169455E	-0-165134E	340046	NOCK OF ST	30717000	C. I. BOA96F	-0.382654E	3042926°0-	-0.112303E	0.340865E	-6-186423E	Q. 279634E	-0.279634E	-0-805 246	P	0.1223USE	A. 126.266F	-0,196531E	3244428	TO THE PARTY OF	-0.1123GBE		-6-106423E	RIGHEA	3	C-393061E	-0.186423E	0.561516	-0.372046E	0.1123@E	-6.168459E -0.279434E	-0.238149E	100710	ş
.	FORCE	~	89	*	9 6	ä	•		3 5	9 6) ¢	2 E	2	4	1	4	76	66	4	' ;	# 6	9 7	2 17	6	۹ ,	2 2	}	M	4	: N	31	N	•	*	2	n A	~	•	•
*		5				ដូ	a					5	ë	6	6	6		S	*				38		5 1	56		6	60	80						38	60		5
CUTOFF		- 6- 51.95 052	- 0. 74 39 31E	- 0. 5021136	-0-130562E	0. 6422756	3505501-0-	200000000000000000000000000000000000000	100 3748 400	307070600	70 44 44 44 44 44 44 44 44 44 44 44 44 44	0. \$826 545	- 0° 1304 566	- G-81960%	0. 372846E	» 0. \$20117E	0. S&1516E	- 0. 942275E	3.02.012.00		C. 13924	0 44939ACM	- 0. 952654F	2682060		- 6. 50255 SEC.	Q. 279634E	0.1324416	- 6-1017406	- 2, 1123 (28	- 0. 1626 54E	- 0-1346626	-0.902113E	- 0. 763991E	-0. 61 \$6 GSE	0.16643EE 0.559269E	0.1064.7F		0.5815106
	FRACE	983	~	2	2	12	-	• •	> (2	P. 10	3	r.	m	01	7	7	35	*	• !	2!	;;	: 23	•	- 9	2 2	ä	N		2	R	-	P	13	2	กร	-	• •	-
	•	¢.					6	3						11	l I				2	•				:	9			**)			15	;				4		
		0139					9	170						025.9	<u>}</u>	1	84		4						À 55			G S S S				9110					9440		

FIGURE III-B.17 CONTINUED

を 1000 では、

		8888	8888	5858	385	5885	32833	38885	888
		6 4 4 6 4 4 6 6 6 6 6	9021 836 3728466 9290978 2796346	2 2 2 3 8 m m m	136662E 7216 90E 279636E	# # # # # # # # # # # # # # # # # # #	, 444 1920 446 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	44 44 44 44 44 44 44 44 44 44 44 44 44	132662E 112343E
		1392946 1882346 393688 3262406	9021 23 E 372846E 929097E 279634E	961936E 139296E 372696E 196532E	134662 7216 90 277634	186423E 614384E 130496E 482654E	5619368 1866,236 1823,636 173,666 273,666 273,666	100000 1000000	134662E 112363E 35668
		0. 1992 0. 1998 0. 3939 0. 3268	\$ 5 5 5 8 4 6 6	9 9 9 9 3 1 2 2	9 9 9 2 2 2	9999	4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4	4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4	2 2 M
		4,10	7 700		7 50	9009	7777	7 7 7 7 7	770
	FORCE	日本の中 日本で中	e 260	* 988	₩ Ø ₩	6 0 0 m	9 N# 4 H	କ ଅଷ୍ଟେଶ ଲକ୍ଷ୍ୟ	0 9 P
***	Ş								
673		6660	6 6 6 6 6	\$ 00 8 0 \$ 00 0 0	000	5 6 6 6	2200	999999	000
> 6		8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8	3 記述系統	7204 2004 2004 2004 2004 2004	治の切り	2月15日 1999年 1998年	1366 SK 1366 SK 1396 SK 1459 S	2 22 2 2 2 2 2 2 2 2 2 2	-0.186623E -0.319663E 0.372846E
		0.1728 0.0928 0.9926 0.9926	-0.561316 -0.463991 0.862230	∞ > − − − − − − − − − − − − − − − − − −	0.33003 0.11230 0.16845	0-13940 0-13953 0-39265 0-39265	- \$2211 - 13666 - 16366 - 76368 - 16368	6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6	3 5 7
8		တဲ့ တို့ လို ထိ	2 2 2 2 2	0 0 0 0 0	0 00	0 0 0 0	6 6 6 6 C	9 0 6 0 6 0	တို့ စို့ စိ
w	w								•
215	FURC	- NOM	4 2 2 2 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4	6 6 4 4 6 6 6 6 4 6 6	~ 36	4 4 4 4 4 4 4 4	经股总等的	と まなを 日本 の 日本 の 日本 の 日本 で 日本 で 日本 で 日本 で 日本 で	4 % K
	ъ.	8448	9444	44884	07	8 6 6 6	288556 2 88556	262668	004
		411 812 847 841	តាកាភាពាភា	AAA . 44A 268 COD ABS	414 404 404			90 40 40 40 40 40	
		201033 326240 326240 393061	365016 186423 819609 557269	-0.9619166 -0.1714436 -0.6524816 -0.326240	56 19 16 6 8 19 6 05 8 4 2 2 7 5 1	.112303 .373061 .336260	7. 104023E 7. 185861E 7. 721890E 7. 539266	0.34241 0.133441 0.386384 0.386384 0.130466	0.523117E 0.551516E -0.763991E
			2 2 5 5	9619 1714 1123 6524	8 8 8				5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5
		၀ ခုစုရ	စုံ ဝစုံဝန	9 9000	ဝရာခု	ငှိ ငစ်ဝှ	ဂုံ ခုံ ဗုံ ဗုံ ဇံ ဇံ	ငှီ ကိုစ်စ်စ်ပုံ	ှိ ဝင်
	FORCE	RARE	* 2368	~ 225	< 24	< 222 3<	n = 22 28 8	KARRE *	s ឌ ដ
	F0.	on 1414 to	es es es m	14 14 tal		20 00 64	- 14 19 19		
		9 6 6 6 6	00000	60000	30 3	5888	666666	225225 22525 25525	97 97
		139294E 105134E 130496E 982654E	186623E 320117E 112363E 168659E	1686 6236 11926 2406 5316	.9621136 1895016 372666	2 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	# 10 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	6.1037986 0.1091446 0.1392946 6.3920616 6.3502606	561916E 165916E 372846E
		139294E 105134E 130496E 922654E	186623 320117 112363 168659 168459	220162 106623 407192 326240 196531	962113 109501 372666	291 5336 291 5336 139294 130496	5815186 1664236 1123636 972646 9923756	25 25 25 25 25 25 25 25 25 25 25 25 25 2	5619 1650 3728
		ರರಥೆಥಲ	9 9 9 9 9	.c. 223148E .c. 188623E 0.407192E 0.195531E	ရှိ ဝှရဲ စ	2 424	ને લે ને ને ને ને	-6.1637986 -6.2691496 -6.1691346 -6.3939616 -6.3930616 -6.5162608	ရ ရရီ
0.0		• •	• • • •	* * *	• •	, ,		• • • • • • • • • • • • • • • • • • • •	• • •
	8	# 00mm	4 22 28	4 × 4 × 6	~ 28	m 28#	4 4 4 6 5 m m	~ ******	4 2 2
\$	ŭ.	83383	32838	2355	3 3 3 3	3 555	33233 33233	8222822	333
100								· · · · ·	
5		0. 3728408 0. 1123638 6. 3262408 0. 9824568 0. 1364968	.0. 136662E 0. 361516E 0. 369643E 0. 372846E	0.106423E -0.10179E -0.115379E -0.145967E 0.532654E	-0.1040236 -0.1866236 -0.7639516 0.5392696	-0.3428988 -0.3821498 0.3728448	#028 138 1384 628 1196 659 1439 818 2796 348	-0.5815166 -0.1823636 -0.3723636 0.982656 0.3263406	0, 502113E 6, 106423E 0, 927967E
		F 1881	2 3 3 4 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5	122	2 22 2	3 25 3	2 2 2 2 2 2 2		8 28
		0.372840E 0.1123635 -6.326240E -0.982696E 0.136496E	တို့ မိုင်စ်စုံ	ဝ ခုခဲ့ခဲ့ခဲ့	-0.104023E -0.186423E -0.763951E 0.539269E	- 0.342896E - 0.2881.99E 0.372644E	- 0-1346625 - 0-1346625 - 0-6196656 - 0-7196345 0-2796345	- 0.1864234 - 0.1823435 - 0.3723465 0.9826245 0.3262405 - 0.5930615	င် စီဝ
	w		M 0 1: 2 N	M 9 4 0 F					4 2 L
	PORCE	<u> </u>	e Star	# Star	4 8 5 5 5	* 2#X		~ PROROS	``##
		•	2	®	2	8	#	8	83
		•	•	•	185	•	a	Δ.	A
		9539	8 8 8	\$320	988	9330	9 8 8	9816	Sico
					~	_	-		

FIGURE III-B.17 CONTINUED

		È	8	83	\$	5	3	38	6	S	3 6	8	*		8	51	9 6	•			88				:\$		E	5	s g
		<u> </u>	36		<u>س</u>	3	3	1563 408	8 H	8			A88		3	8	3		90	2	26964 66 26964 96	3	7	3	1251126	*	*	36.5	25426 FG 425560E
		349 2 666	84423	1223055	*	1961	9	Ž	\$ 555 G	32624		8	200		275534E	3262408			53 WZ 4.0E	\$		324240K	328	92	33.	Š	994269E	2	
		\$1 \$2	O. 20	32	9	3	A C		ş.	A:	4 s	id	2		5.5		2 * 4 B	}	9 9	9.2	2 ñ	多多	.₩	\$ 6 6 0	Š	સં	e e	4	e e e
		•	Ĭ	•	•	_	-	ĭ	Ĭ	_	•	, •	4		Ĩ	ĩ	-		_		ī	•	_	Ī	_	ī	Ē	Ī	
	FORCE	8	0	8 K	2	0	(C) (C)	4 kg 6 kg	•	M C	9	6 CA	4		ø	9 (n e	\$	ø	8	10 KG	•	2	₩ <	e S N	I	6	97	N O
2	3		**	&	* •	6 2	(~ (N 120	_	(6 (.	• FR	450		•	w i		· es	5 14	P0 1	· **	(/ ** :	 - 1	w 494	ar .	_	(~ (- w
•••		6.0	Ġ	0 3	6 4	0	9 9	9	٥	33 (9 đ	9 0	0			4	96	3	0	0	9 Ø	Ø	0	O (0	C	Q	88 50
AS		\$ 5 # 18 18	8	2022 2023 2023	2626gg	3368	31	200 A	3926E	9)		3		出るの		があれる	7	866 聚	がの	######################################	484	18 B	27.5	を	5	526016	275	
3		0-16865 0-16865	173	200 200 200 200 200 200 200 200 200 200	988	.13069	200	0.86129		A 20 40 40 40 40 40 40 40 40 40 40 40 40 40	460	3	1		Sea 94.93	0. X 4 8 63 5	36	2	39388	100		9-27963	500	₹ . Q .	2000	2	.653	4	0.24847
123		o e	-0.17	4	60	¢	ą.	စို	•	ě (9 6	် ခ်	Ŷ		9	#	őď	ရှိ	•		9	3	•	• ÷	ó	é	ė	Ç.	ာ်မ
371	w	6 9 8 8	•	20 64	0.4	•	•	3 ¢	ଣ	~1	- 6	1 50	m		•	5 0 (N Ø	3	89	19	6 4	49	**	p= 1	9 99	m	•	en .	N P
W.	ğ	N A		→ %	ŇÄ		<u>بر</u> د	i M		-4	4 F.	14	173			ent (*	1 FÀ		cirj (Ně và		64	a t	4 14	#		147 0 (N N
		9			25		S			8					80	20	ě	8			33	æ	8	8	ő	8	6		88
		2 S	3	22	196533 E	*	30 C	3650000	377	230496E	y u	200	2		33E	0-6926BAE	4 K 2 S	12	3	2	0-1969146F	30	3 5 5 E		1 × 1	3 2	35	3	8 8 8 8 8 8
		0.276434E 0.555249E	ues23	-587284 572846	200	-582454		189	39306	3	Ş	3	42		168455	Ž	7	3	326243	622	200	130496E	Š	Ñ	604782	전 교회 교육	.042275	868	22525
		9 9		an op		5.0	•	10	6						001	6			4		90	200		M.	4 20	e.	9.0		₩ Ç
	***	- 1	_	- 1	- 1	Ŧ	~ •	7	¥	7	Γ-		T		-	_		T	Ŧ	_	- γ	Ĩ	~	F	_	ĭ		_	¥ -
	FORCE	RA	80	ឌន	SR	•	21	R	4	2:	3 2	K	Ħ		ø	2	11	8	*	23	am	4	2	£	R	23	B	2	NR.
	ĭ	. .		~ =	~ ~	_		- 46	F -	۰.	- 44	. <i>6</i> 3	a			~ 1	. #		~	6 0 (- 6	65	es (~ 0	. 03	- 0	•	6 2 (40
		R 67			m 07		# C		_	_		-	80	u	*	6				***	200 H	_				R 00	6	-	ក ភា ១ ១ ១ ០
		6.842275E	798	0.561516E -0.1454676	982481E	893688	130496E	4774	89	Z.	100707E	192	40-4	2	153	273	461	473736	Z77434£	190	261230	8°3282488	5	Š	516	156390E	3262906	5	76531E
		3 3	103	22	982	999		38	98265	32625	ž	18		A SE	3	8	200	2	K	100 m	33	20	200		484	22	326	10865	
9		÷	2	ဗ မု	3 4	3	4	4		Ö	36	ð		\$	ş	\$	i i	đ	ő	8	44	4	ő	ģ,	3	ģş	þ	3	දු ද
ð	eu La	4 6	*	- 1 - 1 1	.	~	ه هـ		***	8 2 4	• α			&	•	4			M	.	W cd	64	•	.	.	-a -	•	-	n 42
	FORCE	8 8 8 8	•	त्नं स्व	200	.,,	4	¥ m	••		ñ	ÍŇ	A	Ā)	•	# (F	Ä		•••	Ä	R	**		à é	N	8 8 8 8	•	9 9 i	2 % 2 %
10F	-	38	6	55	38	9	5	36	6	6	9 6	; 8	5	3	8	51	58	8	88	5	3 3	\$	5			38	6	5	35
Col		異異	3	3 3	22	3		2	£	¥!	X M	18	8	Ř	*	Ų.		2	3	#!	X 2	*	8	X I		9.254126 -9.254126	*	₹:	12
		N Z	623	2202	292	Š	262	ž	392	*	Ç	1	3	7	392	252	700	ğ	ż	336	Ş	3	Š	Ŋ	24	35	200	8	
		0.112303 -0.275634	-6.562516	- 6. 2881 48 0. 372844	0.4071 \$2E -0.326240E	- 0. 393043E	40	0. CCA782E	- 0. 5592690	- 6. 27% ste	0.0422395 0.0422395	という	221220.0	- G- 26163 G	- 0. 55926%	0. \$2624G	0.23549E	N. O.	-0-130498	9	######################################	- 6.27%	- G. 554269	- 8- 8022 75 - 8- 9464 8	Š	લું લું	0. 27% sq	6. 5226 SA	0.6524816
		•	•	•	Ī	Ĭ			ŧ		•	,		•	Ī	_		•	Ī			Ī	Ī	• (i	•	•		
	FREE	2 2	M	22	ដូដ	8	2:	12	-	po f	3 =	N	S	Q	M	9!	3	2	N	S	ar	~ 3	9- (M 6		35	•	2!	38
	E	•	•						•						P u				æ			•					0		
		2	24			n			\$2						2				Z			2					8		
											18	6																	
		9220	4586			9250			9810						9210				9220			0230					4810		
		ă	8			ã			a						O				ä			ē					Ö		

FIGURE

111-B 17

CONTINUED

						.,,	3 (_			6	6	5	3	S		E	6	ŧ	8		3	3	3	8	í	÷			8	ŧ	8		8	3	
				338		8	# 10 m	¥,	2		¥	A A A	本の記	が発売	978		750	9	100	8		4	10	2	200	į					•••			-	_	
				-6. 64.73 YEC		5	100 K 100 C		23 4 D 4 DC	1000	の様に命が年代	0° 9826546	320240E	363.25.96位	8047 aze		Bo 0482 75K	22.A	422	130		200	W.S.	176	26.04 TBS	4	THE STATE OF THE S	202	202	6269	984.949B	まるた	;	で、ころのもおびた	22.62.45E	
				-		HORACOCA COL	3	\$	4	,	3	ટ	e é	2	ş		8	6	- C. C. W. W. W. W. W. W. W. W. W. W. W. W. W.	- G. 20042 96		* C. 14.049.55	-0, 342663E	-9- 947472E	ž, ď	ě	•	- 0- 120240E	9	- 4° 202654E		K,	1	3	3	
	400			•	6	ý G ý P	9 W	è	4	,	7) (ř	Ç,	Ř		•	9	en Pi	9		Φ	0	9	8R (C)	*	* 6	3.	3	Ž,	Si .	A	•	₽.	e m	
2			9	9		2	9	•	43		= \$ 3 \$	3	2	D	œ O		P	67	60	9) (G)	C 39	杂仓	40	9	r 8	7	• 0	» ç	- :	**	20 (C)	۲. ۵	3	.	-	1
>		38.87	•	***	2.45	9	3			8			ű l				製	Š,	į	8	,	3		2	×									_		
**		-0-67178et	3	-0.393063E	0.00 % A C. M.	0-269019	0-450926		治を含めず。	SA 547999	1000			一般の 日本の	W. K. & B. & T. E.		現のもである。	552	100	0-2000 000 000 000 000 000 000 000 000 0	4	3	0.3262600		0.00001100	628	3					00000000	A 4444		3000 1 He C	
ci,		9-	}	0	8	9	d	1	0	200			Section 1				9	@.95529£	8	9	9	-8-13664CE	₩°	9	2	-01-04-04-0-0-	2	9 6	10 10 10 10 10 10 10 10 10 10 10 10 10 1		10 10 10 00 00 00 00 00 00 00 00 00 00 0	9		9 1	4 6 9	\$1 6 9 9 8 S
S 82 E	FORCE	Ć.) }	©	4	*	4		e s	67E	e e	: :	1 4	9 6 4 6	ą Ą		49	eri eri	74 : Pd (a d N s	•	a	4	e N	e h	\$ \$	9 4					R,	ď	2 9	7.4	ę
	_	3		6	20	3	3	;	60	6	6	9 6	2 9	9 6		į.	2	## (P	9	2 2			60	3		3	S	9 9) e	•		•	8		.	þ
		9					39/			_	-				Li .	- 1	-	-				_	-		-	-							_			C
		Ş		F. 320240	200	1824	0.24867BE		20年1月1日	27 30 PIE	0-20 MASS	7		44 C 1 5 C 1 C C			3	80	27000000000000000000000000000000000000	7-464740F		305 G2 G2 G2 G2 G2 G2 G2 G2 G2 G2 G2 G2 G2	A (44	ě	908	Š	8	300	ŧ	9	i L	88.8	200		i K
		-0.289919£	•	5	-6.954269£	-0.967472E	69 69	(4	9		8	-O. Persian	6	,	ě	1000	40000000000000000000000000000000000000	9 4	0.6067826		5	8° Z 196 36 E	SECOND C		0-392063 E	-8.130494E	3. 230496 E	-0-3930A3F	-0-1942cbs	0.440434		-0-X79536E	-0.453A015		
	PCACE	3 8	•	•		Ŋ	H	•	•	9	3	â	6	ä	!	*	A :	4 8	1	3 81	•	• ;	21	9	ŧ	*	2	28	N	R	2	,	50	22	1 1	×
		8	8	3	9	20	E		3	20	6	6	20	6	60	*		- g	3	8) 8)	į	5 8	9 2	3	?	ē	2	ć	-	雙	E	3	63	63	•	_
		295	8			9	¥.	E S	2	4	× + 6	ğ	725	2	3	Š								_		_	-	_				_		_		
		C. 280629E	C. DAGARKE		National Party and Party a		U-145712E	6. \$24.24.0E		Š	6.4326546	9-326340E	4.50	Q-248472E	884782 8	C. 194940C	ž	1	9	12956 Se	C. BAS STREE		C. 0076965	915050-0		G. 5526548	4. 325200E	9-326240E	982654E	961258E	#\$\$\$\$€	# 0678E	265	936	4	Š
_		3	-				3	6.3		10 007 00 00 00 00 00 00 00 00 00 00 00 0	ð	80	-0.547672E	9	3	e e		5. 3 645 2 x	9	0.6293608		3	} } }	3	1	3		3	3	r F	8 4	Z,	C. 98265 ⊕E	-0.55926 PF	A. AGBAGS E	ì
ę	범	•	98			- 		-		•	_	•			_	_					•		•				Ŧ		•	,				Ē		
	FORCE	8	7"	' ;	1	4 6	4	*	, .	8		8	53	#) 	Ä	4	*		26	2	R	•	2	6	•	W		9	2	2	R	2	*	11	7	2
*		8	Ö	Ę	5 6	9 6	5	9	6	; {			C	\$	80	80	6	*	5	80	40	E	8	8	•	3 8	3	51	3	9	8	\$	6	5	č	;
COVE		- 0.15639@	0- 13065E	- 0. 4834 4AE	3	MACANDA CO	2	200	200			N.	3	5	3	3	30E	3	116	300	61E	9	8	136	į	2	2	¥	į	5	3	H				
		156	130	2	6	9	į	O. 156455E	O. 8423779	A 8801.05		7		- 6° 156356	0.4905166	0.1686356	3226	- 0. 140425E	- 0.652441E	2	O. 343061E	262	53.02	8	. 6499366	9 6		20 C C C C C C C C C C C C C C C C C C C) (3	100 PM		C. 6422 79E		222	
		ŏ	Ġ	Ç	6	ċ	5	ó	Ó	•	5 (4.27.3034E	ģ	9	å	ó	- 0, 9826 54E	Ĝ	9	ő	0	9	-0.5392692	- G.259919E	6	,	3 6	\$	•	10 E 10 E 10 E 10 E 10 E 10 E 10 E 10 E	3	3	800	- 8.0 XX6246E	- G-842275F	
	WKCE	32	N	e	2	8	j	~€	•		1 6		Q	8	ft FA	m	2	11	Ž,	H	~	9	ส	Ļ	çı	4	- d	1 0	} (9	4;	ñ	m ;	<u> </u>	7	Š
		8	31					Ä								8					\$				10	}							8			
																		, 0	-																	
		4510	0339					orsp								0129		18	1		CISP				0110								oisio			

FIGURE III-B.17 CONCLUDED

22	000	920	8 •	0°0	0:0	9	Ø2 @	9.0	9	800	6.0	•	6 0	9.0	9.	8.8
ê êim	0.0	6-9	0.4	- C. 6666692E CZ	9	0°8	9	6.464669WI C	ф 3	0.0	**	-0.446645RE 62	©	⊕	8.9	0.6555692E 02
at Se	0.0	0.0	6.3	9	0.0	0.0	0°0	9	0 0	3	0.0	0.0	0.0	9*8	0	0.0
2	-	**	æ	•	Ø	٥	(+	•	9	9 88	646 144	22	2	2	61	92

OPRINT OF MATRIX LOADS - RECTANGULAR PRISM ELEMENT, CANTILETER BEAN Frank III-B.18

displacement papalix for load condition

2 x

29	0.0	-0.30467466-03	-0.20599946 E-06	-6.47.243157E-04	6.4	-6-90667450 E-65	-G. 25599066 E-04	-0.47243229E-56	0**	-0.38465412E-09	-4-236989376-04	-0.67 <i>2</i> 62473 <i>E</i> -64	9.0	-0.99665967E-CS	-0.25853542E-04	-0-47242673E-94
ø	0.0	-C. 43426433E-C3	-C. 96566117E-C5	- to 13699 138E-04	0.0	0.4342560TE-85	0. 1656 GB TCE-05	6, 13695341E-66	9	C. 43424 C85E-E9	- C. 9856 % 786 ~65	- 6. 13693461E-06	6.0	6.43426759£-65	0,085457725-65	6. 136439782-66
3	0.6	0.7212636X-06	C. 57308502E- 66	0. 40856289E- 66	0.0	- 0, 7288 2010E - C6	-6" 58634444E- 66	- 0. 6652671TE- 06	9° 0	-60 72242346E-06	- C. 5467 ca 235- co	-0.60687034E-06	9.0	6. 7215-69-6E-85	6.9767275E-06	6.6973469E- 06
3	nt	N	•	4	8	•	(>-	€	•	ន	2	2	2	93	ន្ទ	3

DISPLACEMENT MATRIX - RECTAHGULAR PRISM ELEMENT, CANTILEVER BEAM FIGURE III-B.19

22	0 - 32339094 E-02	-0.610079% E-04	-0.27376453E-02	-0.18739700E-02	0.27313232E-92	-0.14524460 E-02	-0.41730472E-62	-0.41713713E-02	0.76719238E-02	-0.63163116E-03	-0. e4371872E-62	-0.460543216-64	0-17769732E-02	-0-23851395E-02	0.5170.518 E-02	9.35946732E-02
*	0.66678690E 02	0.78672131E-@	C. 53789468E-Q3	0. 38146973E-63	-C. 66676978E C2	C. 32.234 68 68-62	-6.36373133E-@	-4.40283203E-@	C. 66677861E 02	-0.57346290E~G2	6.29077330E-62	6. 32 2083 96 E-02	-0.64678787E 02	-6-24f4f5f7e-42	0. 225636363-62	6.22436420E-#2
ii da	-0.2M77384E 02	0.47016144E-03	0-7027626E-02	D. 74C03127E-02	0.284768636 02	6. 24918707E- 63	0.63781738E-02	0.2670268E- 02	0.2047E012E 02	-0.5722065% - 03	-0.33266878E-12	-0.5775451R- 62	-6.26677570E 62	-Co (25/2503E- 83	- 6- 7805 63642- 52	-0-34204102E-62
e e	rej	R	ค	•	th	•	Po	₩	•	2	32	2	e e	\$	83 ##	3

FIGURE III-B.20 REACTION NATHLI - RECTANGULAR PRICK ELEMENT., CANTILEVER BEAN

STRESSES

ISTRESSES EVALUATED AT THE ELEMENT CENTROLOS

	8	516ra- ex 0.66732 ce=95	5169Ab- Zx 2.0	83 BMA-21 6• 60 Py 72 GP F- 99
	*			
	à	29		\$
	2	- 82 84.48	X -	%₩ \$4 \$2
	ş.	1884 2513	0 SI 684- V2	20 cm
CLEMENT CRÍD POINTS	•	28-34-8215 28-34-82 28-34-83	8 0 d	51 GRA-72 - 8. 42 9153442
ă Î		%		1 5
8	w		È	282
8	_	S ES S 107 A- XY 206 102 29		S ES S TON A-XY -288102 29
đ	-	pergrang stresses signa-ky 79e-04 -9.286ig224e-03	Hendrane stresses 53gm-xv 0.0	Perioane Stresses -3 Toe-ca -026510229e-e5
elebent type	\$2	pergrane Signs—z 0.63896179E—04	hendrane Signal Dob	remerake Signa—2 O. 639 043 70 e-co
ELEWENT ALMBER	-	- 3€39227 44 °C	Sigha-v	\$1684-y 0, 44822643E-04
LOAD COMDITTION MUNDER		MPM BIT BENDAT STRESSES STRESS STOMM-K POINT 0.28610227E-00	elenent appliko stræsses 87aes s Poskt sloma-k 1 0.0	KET ELEMENT STRESSES STRESS POINT SICHA-K I 0-280102295-C4

STRESS OUTPUT, ELEMENT NO. 1 - RECTANDULAR PRISM ELEMENT, CANTILEVER BEAM FIGURE III-B.21

STRESSES

ISTRESSES EVALUATED AT THE ELEMBIT CENTROLDS

LAAD COMDITION MINDER

		ø		art.	
	a) •••	316MA-2X 0.64-320272	516MA-2X	53 5 42 - 24 6. 66 7772 52 53	
	**	2		2	
	0	- C- 421534-92 - C- 431674-92	**	51 GHA- VZ - 8. 62 92 93 42	
	₩.	61 (24A-	Signa- vz G	4 6 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8	
E.ERENT CRID POINTS	•	3 6		4	
9	æ	69		5	
SENT	N	1- XV X2 256	≯ .i.	7 X X X X X X X X X X X X X X X X X X X	
8	eri	Mendrane Staesses Sigra-ny (79e-04 -0.28010224e-05	Streses Signa-XV O.O	hembrake stresses 1-1 3 tor-or -0.225102246	
esement type	52	menurane Signa—Z O.6389179E—O4	nemorane stresses Signa-2 O.O	немвадке 8 1 GMA—2 0 - 619 9 62 77 E—08	
ELEWENT DIMBER	•	49~3E39ZZ344 °O A~949LS	Signa-v	21 Gra— y 0. 44 822 6 432 - 24	
LOAD COMDITION MISBER	•	APPAR ENT EL EN ENT STRESSES 87 kess Point Signa-X 1 0.286 lo229E- 64	e enemt applied stresses stress point signa-x l 0.0	net elemen stresses Stress Point Signa-u L G-236102295-c4	
•		27465 57465 70147	erent Stress Point	net ere Staes Point L	191

FIGURE III-B.21

STRESS OUTPUT, ELEMENT NO. 1 - NECLANGULAR PRISM ELEMENT, CANTILEVER REAM

RECTANGULAR PRISE F C # 1 # F F F STRESSES

ISTRESSES EVALUATED AT THE ELEMENT CENTADION

	ih M	51 GMA- ZH - 6- 46 T3 (10-42 E-04	Signa- 2n	516M2-12 0.46TYYD92E-64
# TS	1 7 6 14	TA-DIGUES TO	3.5 (CAPA-4.7.2)	68-7766888-86 68-86-786888 68-86-786888 68-86-786888 68-86-78688 68-86-78688 68-86-78688 68-86-78688 68-86-78688 68-86-78688 68-86-78688 68-86-78688 68-86-78688 68-86-78688 68-86-78688 68-86-86-7868 68-96-7868 68-96-768 68-96-768 68-96-768 68-96-768 68-96-768 68-96-768 68-96-768 68-96-
B.ENENT GRID POINTS	3 2 10 11	MENBRAME STRESSES STEMB-XY SZE-OB 0-783137635-03	Rehorane Stresses Struggeny 9.0	Hendrame Staesses S 2078-17 S2E-03 0.20313263E-03
ELEPENT TYPE	ୟ ଖ	reparane Signa-Y O. Bagolisze—ob	Rendrane S Signa-2 O.O	Hendrane 5: S1674-1 -0. 106811 52 f-03
A ELENEAT ALREEA	N	Sigra—V -0. 30517378E-04	83.694.ev	*0-3878718 *- 20517576
LOAD COMDITION INDOCA	ed	Apparont regions stresses Struss Print Signa-H L 0.30217372E-04	elfart applied stresses Stress Point sama-x 1 0.0	HET ELEMENT STRESSES STAESS FORM SIGNA-H 1 0.30317572E-C4

FIGURE III-B.22 STRESS OUTPUT, ELENEMT NO. 2 - RECTANGULAR PRISM ELEMENT, CANTILEVER BEAM

医上后 医医 化 书 FER THE RECTANGULAR PRISH (STRESSES EVALUATED AT THE ELEMENT CENTROIDS STRESSES

pi.	Sicks-2x -0.49591064	SIGMA-EX	51674-2x -6,4931104-2x	
POINTS 3 21 35	\$1 GMA- YZ 0. ZG11 78965 G3	S1698~ V2	51 GM-712 \$. 2011 18%E-03	
ELEMENT CRED POINTS	STRESSES S 169A-XY -0.40034321E-34	REMBRANE STRESSES STORA-XV 0.0	Rehbrane Stressee 1014-XV 1716-ov —0.400543216-04	k edekeny,
elenent type 52	REMARANE STRESSES SIGNA-Z SIGNA-CO-30517578E-04	renbrane 5 1 Gra-2	Nekbrane : S 1 G M	- RECIANGULAR PRISI
ELEMENT ALMBER	SIGMA-Y -0.39672852E-03	SIGNA-Y	S164A-Y -0.39672852E-03	STRESS JUTPUT, ELEMENT NO. 3 - RECTANGULAR PRISM ELEMENT, CANTILEVER BEAM
LOAD CONDITION NUMBER	APPALDNT ELEMENT STRESSES STRESS POINT SIGNA-K L -0.610351565-C4	CENENT APPLIED STRESSES STRESS POINT SIGNA-X	KIT CLENGY STRESSES STRESS POINT SIGNA-X 1 -0.61035156E-CA	FIGURE III-B.23 STRESS OU

5

	*			
	9			
	u			
S.	-			
, ME CO	*			
62	•3			
element grid points	~			
SAG	~			
₩	•			
5		2222222		2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
4	52	25 3 2 5 4 5 4 5 4 5 4 5 4 5 4 5 4 5 4 5 4 5		######################################
ELEBEAT WYPE		22222222 22222222 222222222	ĸ	FZ 270561976-02 270561976-02 27054086-02 230547996-02 230547996-02 275076-02
ಷ		6.320.53608E-02 -0.27636057E-02 -0.29954930E-02 0.2495450E-02 -0.3495450E-02 -0.3756935E-02	00000000	6.32653509 E-02 -6.27653509 E-02 -0.276349 10 E-02 0.276349 50 E-02 -0.33549 50 E-02 -0.33545 50 E-02
*		-		04400440
ELEMENT ALPBER	-	8888888		3838333
# FE			4 ≯ 40 ≯ 00 00 00 00 00 00 00 00 00 00 00 00 00	V)
3		FORCE F V 66672865E 66672876 66677841 66672818E 66673818E	# # © ≻	FORCE: 66678698 666728068 666728068 666779418 666723418 666723188
M		FORCE: C. 66672845E C. 66672845E C. 66672843E C. 66671843E C. 66672448E	ဝစ္ခန္ဓဓဓ ဗီဗီဗီဗီဗီဗီဗီ	FORCE C. 66478663E C. 66472804E C. 66677841E C. 66677841E C. 66677841E C. 66677841E
盉				4444444
NUMBER		255555		77.77 W M M 77.70
	-4	♥	in ea	
LOAD CONDITION		1. ENENT FORCE -0. 20474176 0. 20476896 0. 20476896 0. 20476896 0. 20476896 0. 20476896	APL IED CO. 00 00 00 00 00 00 00 00 00 00 00 00 00	FX FCCES -0.2847417E -0.8918496E 0.89418012E 0.89418012E 0.8941864E -0.8941865E
9		E E E E E E E E E E E E E E E E E E E	7 600 600 60 60 60 60 60 60 60 60 60 60 6	
LOA		d * * * * * * * * * * * * * * * * * * *	2	#ET ELERENT FORCES 2 -0.28474 2 -0.59182 4 -0.39184 5 -0.28478 6 -0.59184 7 -0.59144
		24 24 25 26 26 26 26 26 26 26 26 26 26 26 26 26	de 194	風炉 るとまんからてき ほ
		444 404	해 운 194	# 6 # 6

FORCE OUTPUT, ELEMENT NO. 1 - RECTANGULAR PRICM ELEMENT, CANTILETER HEAM

III-B.24

PIGURE

6.68.88 # W W & RECT 52000 48 3 # L FORCES

	LOAD CONDITION NUM	EA ELEPENT NUMBR	ber elepent type	plehent said points	23	20 EM 7.5				
	ent.	N	52	M	6	**	₽=	•	4	(F)
88 20 20 20 20 20 20 20 20 20 20 20 20 20	FRENENT FORCES FRENENT FORCES O. 117969738 C1 O. 59153878 C1 O. 5915478 C1 O. 5915478 C1 O. 5915478 C1 O. 5915478 C1 O. 5915478 C1 O. 5915478 C1	FORCES # V	62 12 2 0 10 1 E - 0 2							
195 195	7	6.9000000 6.9000000000000000000000000000	\$\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\							
5.0 PC BF ≈44448064	FX EXEMBER FORCES B	FORCES FV -0.6665537E 68 0.66672538 68 0.66672538 68 -0.66673518 68 -0.66673138 68	6.1220 M316-02 6.2872 M316-02 6.4822 M316-02 6.4823 M316-03 6.717 14865 E-03 6.2941 665 E-03							

Street Contract to the Street of the Street

Force output, element no. 2 - rectangular Prism element, cantilever bean

PIGURE III-B.25

医乳 医被除器 智 RECTANCULAR FORCES

	S			
	13			
	m			
ELERENT GRID POTOTS	•			
22	**			
	23			
3,630,6	•	•		
ELEMENT TYPE	N 56	6. 34. 69. 75. 60. 50. 50. 50. 50. 50. 50. 50. 50. 50. 5	0 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4	6. 13.25.20.75.62.62.62.62.62.62.62.62.62.62.62.62.62.
A ELEPENT ALABER	m	FORCE 5 - 0. 666670 488 02 - 0. 666670 488 02 - 0. 666670 128 02 - 0. 66670 128 02	8 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9	23 34 1969 9 9-
LOAD COKDITION NUME,A	⊶	######################################	7. APPL TED POACES 6.00 0.00 0.00 0.00 0.00 0.00 0.00 0.0	#FF BLEMBNT FURCES 1 0.759847705-02 2 -0.35914245-02 3 -0.35914245-02 4 -0.317979795 03 5 0.317979795 03 6 0.317979795 03
			196 196	## ### ###############################

111-3.25 FICURE

FORCE OUTFUT, ELEMENT NO. 3 - RECIANGUEAN FRISH ELEMENT, CANTILENTE BEAN

C. TETRAHEDRON ELEMENT

An eighteen element cantilever beam subjected to a constant pressure load is shown in Figure III-C.1 as the second example. This figure shows the loading, idealization, dimensions and material properties. The preprinted input data forms for this example problem is given in Figures III-C.2 to III-C.10.

Inspection of the figures shows that the input data is very similar to that given in the preceding example with the exception of the element pressure input data form, Figure III-C.9. On that form element related pressure data is recorded for each of the eighteen elements. The MODAL and REPEAT options are used to efficiently enter these data. The MODAL data indicates that a zero pressure is input for each of the four faces of each tetrahedron. The exceptions to this are given by the data cards following the MODAL inputs. In this particular example face 134 of elements, 1, 7 and 13 is pressurized and face 123 of elements 2, 8 and 14 is pressurized. It must be noted that the face numbers given above correspond to tetrahedron local numbering system.

The output supplied by the MAGIC III System for this exemple is described below and shown in Figures III-C.11 to III-C.27.

Figure III-C.11 displays the matrix abstraction instructions associated with this example. A complete description of these instructions is provided in Reference 5. Figures III-C.12 to III-C.16 show the output data obtained from the Structural Systems Monitor. These figures record the input data pertinent to the problem being solved.

An alternative means of obtaining the output shown in Figure III-C.12 to Figure III-C.27 is to use the .ANALIC. instruction sequence, Figure III-C.11A, in place of the standard STATICS AGENDUM shown on Figure III-C.11. Comparison of these two sets of abstraction instructions shows that the .ANALIC. sequence requires only two statements whereas the STATICS AGENDUM requires forty-five such statements. A considerable difference is evident.

Reference to Section II.B.4 of this report allows the reader to interpret the .ANALIC. instruction listing. To make use of .ANALIC. the User must input the following three cards; \$MAGIC, \$RUN-GO and \$INSTRUCTION-SOURCE. The next two cards contain the .ANALIC. instructions. The first card is identical to the first card in the standard STATICS AGENDUM of Figure III-C.11. The second card pertains to the .ANALIC. instruction and each entry (DISPL, STR, etc) is defined on pp 25 thru 27 of this report. In this example problem, the three scalar values KALC, NNOM and NRSLEM were suppressed and the default values were used. Table I Page 27 shows that the default for KALC results in the use of the Cholesky triangularization method for solution of the governing equations. The default value for NNOM is eight which means that a maximum number of eight grid points can be used to define the element. default value is forty for NRSLEM. This entry indicates the maximum number of rows in the element stress matrix. Consultation of Table II page 28 shows that NNOM equals 4 and NRSLEM equals 6 for the tetrahedron element used in this example problem. These values could have been used in place of the default values.

It is emphasized that .ANALIC. should be utilized for problems which are of the size that can be executed entirely in core. Depending on the type of finite elements being employed, the upper limit in the MAGIC III System for .ANALIC. is approximately two-hundred reduced degrees-of-freedom.

Figure III-C.12 displays the problem title and material data output. The gridpoint coordinates, temperatures and pressures are given in Figure III-C.13. Boundary condition information and finite element description is shown on Figure III-C.14. In the boundary condition portion of the figure, zeros ('0') represent degrees of freedom that are fixed, (i.e. no motion) and ones ('1') represent

degrees of freedom that are free (have unknown values of displacement). Note that no condensation procedure is used in this problem hence twos ('2') are not used. The second last column accumulates the number of active degrees of freedom which in this problem is 36. The second portion of Figure III-C.14 shows the finite element description. Each of the eighteen elements is called out in turn with grid points, print options and material number. Note that neither grid points nor section properties are presented since these are not required for the tetrahedron element.

Element input pressures are given on the Element Pressure Table in Figure III-C.15 for those elements subjected to such pressures. Four columns of pressure data are presented and reflect the input pressure on tetrahedra faces 134, 234, 124 and 123 respectively. Note again that these face numbers refer to local coordinate systems.

Figure III-C.16 displays the external load condition and transformed external assembled load column. Note that all loads are of zero magnitude since the only loading present in this example is the pressure which is considered an element applied load and not an external load as such.

MAGIC III System output of final results are displayed in Figures III-C.17 to III-C.27. The stiffness matrix is shown in Figure III-C.17. Only the non-zero terms are displayed and it is presented row-wise. It's ordering is consistent with that of the boundary condition table.

In this problem the ordering is

$$\{0\}^{T} = [v_2, v_2, w_2, v_3, v_3, w_3, \dots, v_{16}, v_{16}, w_{16}]$$

with degrees of freedom U_1 , V_1 , W_1 , U_5 , V_5 , W_5 , U_9 , V_9 , W_9 and U_{13} , V_{13} W_{13} fixed.

The matrix of element applied loads (GPRINT OF MATRIX FTELA) is shown in Figure III-C.18. This represents the work equivalent loads due to element applied pressure. It is this force vector, defined at each grid point, which loads the structure. This figure shows that loads of varying magnitude are applied in the negative global Z direction. The next figure, Figure III-C.19, shows the externally applied load vector (GPRINT OF MATRIX LOADS) which as discussed in the previous paragraph, are of zero magnitude.

The displacements of the cantilever beam resulting from the above loads are presented in Figure III-C.20. It is noted that the displacements (U, V, W) are output corresponding to node point numbers and are referenced to the global axes. Figure III-C.21 shows the reactions (F_X, F_y, F_z) . These are also output corresponding to node point number and are referenced to the global axes unless otherwise specified.

The stresses arising in the structure are displayed in tabular form for each element. Typical results are presented in Figures III-C.22 to III-C.24 for elements 1, 7 and 18 respectively. Stresses are referenced to the global axes system and are defined for any point in the tetrahedron element since this element is a constant strain element. (See Reference 7). Normally the user will consider the stresses to be defined at the element's centroid, and the labeling (STRESSES EVALUATED AT ELEMENT CENTROID) reflects this consideration. Since no pre-strain or temperatures were considered in this problem the element applied stresses are zero and only the apparent element stresses are of significance. Thus the net element stresses and apparent element stresses are equal.

The last set of output is given in Figures III-C.25 to III-C.27 and consist of the global oriented element forces. Output labeling is analogous to the stress output labeling. The apparent element forces arise from the cantilever deformation and the element applied forces exist due to the element applied pressure. The force point 1, 2, 3,4, in this example correspond to element grid point numbers. For element number one, for example, force points 1,2,3,4 correspond to element grid points 1, 5, 9, 10 respectively.

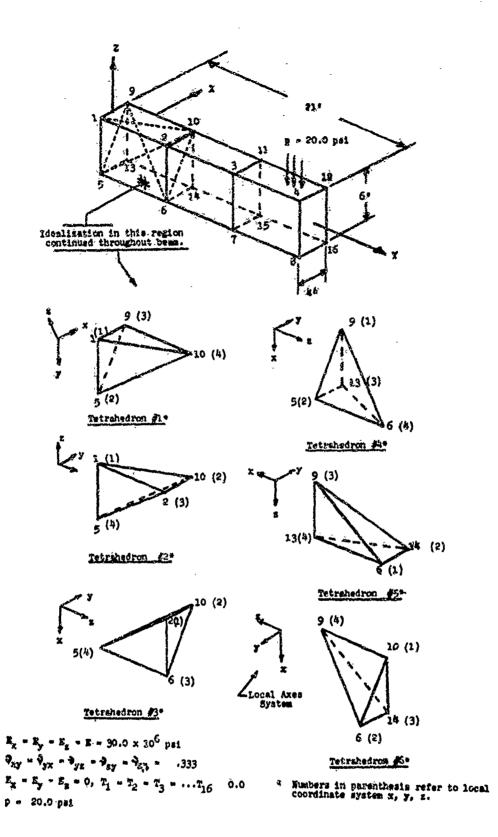


FIGURE III-C.1 TETRAHEDRON ELEMENT - CANTILEVER MEAN WITH PRESSURE LOAD, EIGHTEEN ELEMENTS

BAC 1018

शिवार्थकार ।//

THIS IS THE FIRST ENTRY ON ALL REPORT FORM INPUT RING-AND IT IS RECLIRED FOR ALL RINGS.

MAGIC STRUCTURAL ARALYSIS SYSTEM IMPUT DATA FORMAT

TITLE INFORMATION

NUMBER OF TITLE CANDS

23. The Holon Street William Street							I			1			J	1	I]
13. The Translation Entertainty 15 15 15 15 15 15 15 1	*]			-	1
STATE OF STA	**			1				, 				<u> </u>	£		Ē	
STATE OF STA		*				E			İ				F		E	7
S. Thirthen Broke M. I. Charles Broke J. Sold Strings Broke J. Sol	***	1	Ė		\exists					1	E			7	£	
STATE OF STA	2 2 3	1			目					7			F	7	F	
CS. TETTOLOGIE ENDEN STATE STA	*	3	1			E]	E		J.		E	
23. 23. 23. 23. 23. 23. 23. 23. 23. 23.	90			4][Ē].	E]	F	1	F	
13. 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	13		THE PERSON NAMED IN COLUMN 1		1	E			E	=	E	7	E		F	
(S). The read of the last of t	1			士	1]	E	}	F	7	F	1	F	
S. TRITION E LONG STATE OF STA		乱	-		1		F		F			7	E]	E	
S. The training of the second		Į	3	E				7	E		F	1	E	1	E	
(S. TENERS E SERVE CELETE EN SERVE EN S	73,8	-]	E		1	F	1	F	1	E		Ë	
(S. TENERS E SERVE CELETE EN SERVE EN S	17.		H	E	=				E		E		E		E	
	**************************************			E	+		F	7		╀	F	1	F	-	日	
			H		1		F		E				E		日	A STATE OF
	3 4 5					vnac.	E	T	E	Γ	E			Γ	日	TO DEL
		1	3	F]_	F	_	1	F	_	E	_			日	7
	-	H	团	E		目]	E				日		目	THE
	₩.	1	13	E	+		Ŧ	1		-		_			日	
	200		国	E		B	F		日		日		目		日	III-C.2
	# ST			E		目	F		H	~~~	目		日	(Calendary)	目	
	E T	<u> </u>	目		_		E	1	目	()	日		日		日	FIGURE
温目目目目目目目目	÷		目	E			E		目							K

The second of th

30 1 2 3 4 8 6 7 8 8 8 9 1 2 3 4 (1) ... 5 5 3 2 -(11) 3 3 2 7 ? ALASS DENESTY # MIGIOTTY MODULE MATERIAL TAPE INPUT - TETRAHEDROH ELEMENT, CANTILEVER BEAM MATERIAL TAPE INPUT Jank Adit Marked To Marked 8 š 6 Direction Frince March. Table THERMAL EXPANSION \$ 8 ogeT min Melviel Metariel 6 MAGIC STRUCTURAL ANALYSIS SYSTEM INPUT DATA PORMAT olsoolt öpA * Plettic 19970pin Plettic Orbotropic Y ř ï 3 Direction 3 4 5 6 7 8 9 6 1 2 Orthotrapic 2 POSSECINE RATIOS adduscej EE6N. LBBIS S. M. چر. الح. Direction FIGURE III-C.3 MATERIAL IDENTIFICATION 4 5 8 9 3 1 2 YOUNGE MODULE Ex \$ # 9 MATERIAL PROPERTIES TABLE Lask Cuds 1 2 3 4 8 6 7 1 RETEMAL PLANDER 203

EAC 1578-1

MAGIC STRUCTURAL ANALYSIS SYSTEM INPUT DATA FORMAT

SYSTEM CONTROL INFORMATION

	-		T .
		ENTER APPROPRIATE NUMBER, RIGHT ADJUSTED, IN BOX OPPOSITE APPLICABLE REQUESTS	S Y S T E M (/) 1 2 3 4 5 6
1.	Number of	System Grid Points	1 2 3 4 5 6
2.	Number of	Input Grid Points	7 8 9 10 11 12
3.	Number of	Degrees of Freedom/Grid Point	13 14
4.	Number of	Load Conditions	15 16
5.	Number of	Initially Displaced Grid Points	17 18 19 20 21 22
6.	Number of	Prescribed Displaced Grid Points	23 24 25 26 27 28
7.	Number of Systems	Grid Point Axes Transformation	29 30
8.	Number, of	Elements	31 32 33 34 35 36
9•	Number of Material 3	Requests and/or Revisions of Tape.	37 38
10.	Number of Condition	Input Boundary Points	39 40 41 42 43 44
11.	To For St	ructure (With Decimal Point)	45 46 47 48 49 50 51 52 (/)

FIGURE III-C.4 SYSTEM CONTROL INFORMATION -TETRAHEDRON ELEMENT, CANTILEVER BEAM 204

MAGIC STRUCTURAL ANALYSIS SYSTEM INPUT DATA FORMAT

GRIDPOINT COORDINATE

	D 1	RECTIO	N S	
Grid Point Number	X – R	Y - 0	Z – Z	
789012	the same of the sa	2 3 4 6 6 7 8 9 0×1 2		
		0.6	3.6	(7.)
	-2.9	-7.9	3.0	, (7)
3	-2.0	- 14.0	3.0	(7)
<u> </u>	-a.o	-21.0	5. c	. (/)
5	-2.0	0.0	-3.0	111
6	- 2 - 0	-7.0	-5.0	(/)
7	- 2.0	-14.6	-3.0	(1)
3	-2.0	- 21.0	46.34	(7)
9	2.0	0.0	3.6	(-2)
	2.6	-7.0	3.0	(/)
	2.0	-14.0	3.0	- (/)
	2.6	_21.0	3. ä	(/)
	2.0	0.0	-3.0	(/)
	2.0	-7. a	-3.0	(/)
1 1 1	2.6	_14.6	3.0	(/)
	a. c	-21.6	-3.0	(/)
				(/)
H		▎ ▎		(/)
┝╁┼┼┼	╂╅╂╢╂╂			(/)
 - - - - -	╏ ┪ ╏╏╏ ╏	╏╏╏╏╏	╏ ╏┼	(/)
 	╏╎╏╏╏╏	╂┼┼┼┼┼┼┼	┋┋┋┋┋	(/)
	╏╏╏╏	╏╏ ┼┼┼┼┼┼┼┼	┠╂╂╂	(/)
	╏╏╏╏╏	┠╏╏╏╏	╏╸╏╸╏╶╏╶╏ ╶╏╸╏	(/)
+++++	╏╏╸	┠┦┩╏┩╇	╒ ╏ ╏	(7)
┝╋╂╋╬	╂╫┼┼┼┼┼┼┼	╂┼┼┼┼┼┼┼┼	┣╒╏ ╌╏╌╂╌╂╌╏	
 	┠╏╏╏	╏╏╏╏╏╏	┠╏╸╏╸╏╸╏╸╏╸╏	(/)
	╏╏╏╏╏	╏╏╏╏╏╏╏	┠╌┠╼╏╼╏ ╌╂╼ ╏	(/)
14444	╂╂╂╂╂┼┼┼	┠┦╣╏┩┩ ╇	┠┼┼┼┼┼┼┼┼	(/)
	┇┋╏ ┇	┇┪ ┋┪╃╃╃╃╇╇	┠╀╀┼┼┼┼┼┼	(1)
ШЩ				(/)

GRIDPOINT COORDINATES -TETRAHEDRON ELEMENT, CANTILEVER BEAM FIGURE TII-C.5 205

MAGIC STRUCTURAL ANALYSIS SYSTEM INPUT DATA FORMAT

BOUNDARY CONDITIONS

INPUT CODE - 0 - No Diplacement Allowed
1 - Unknown Displacement
2 - Known Displacement

123458 BOUND

PRESET MODE

		-			
- 1	2	3	4	8	8
	1	ī		Ň	~
	٧	٧	1	-	٠.

TRANSLATIONS			AQ	ŤATį)NS	GEI	VERAL	ZED		
	Ų,	V	Ŵ	θ×	Вy	62~:	: g	2	3	1
,	13	14	15	16	17	18	19	20	. 21]
Ì	ß		J	3 32	,					l

LISTED INPUT

ĺ	Ï	=	0 1 0	1	1	13	14.	15	16.	17	18,	19.	20	21
	_		_		Í	0	0	0	10.		16.	19.	, 40 ,	21
ŀ	†	_	۲	S			· • ·	-0-	<u> </u>			,		
ŀ	1	_		-	X		<u></u>	,	-					
ŀ	1	-	-	3						-				
ŀ	-	-	۲	2	٩									
ŀ	-	•-	┝	H	Н							,		
ļ	4		-	Ŀ	Н				<u> </u>					
	4	_	-	Ļ	Ц					, ,				
ŀ	4		_	L				<u> </u>			`		,	
ŀ	_	-	Ļ	L	Ц					·.				<u></u>
ļ	-		Ŀ	L	Ц									
l		ŕ	L	L	Ц									
L			Ŀ	L	Ц							,		
l				L		,		<u> </u>						
			L								,			l L.,
ĺ											·	ŕ		
I			Γ	Γ	П	J			·					
I	٦		Γ	Γ								,		
Ì		_	T	Ţ	П									
Ì	7	-	T	T	H	,	·		<u> </u>	, , , , , , , , , , , , , , , , , , ,				
ŀ	7	-	r	t	H		<u> </u>					,		
ł	-	-	† -	H	H		 		 		}			

FIGURE III-C.6 BOUNDARY CONDITIONS - TETRAHEDRON ELEMENT, CANTILEVER BEAM 206

ব্যস্থালয়। নুক্ষাত্ত নিজ্ঞান্ত বিশ্বত বিশ

MAGIC STRUCTURAL ANALYZIZ SYSTEM INPUT DATA FORMAT

EXTERNAL LOADS Fig. 19 No. 16 E	ALUES	3	र्वे वर्षकाराष्ट्रकोगात्र		310 813 7 18 18 18 18 18 18 18 18 18 18 18 18 18								**	***				(;)			
CATERNAL LOADS WANTED TO LES WANTE	ALIZED	3	हो। है। विकासकर करिया	~	23 48 678 6012															N ELEMENT.	
EXTERNAL MOMERY MOMERY MATOURE III-C.7	± ₹		5		1 5	1 1 2 2														٠.	
	LOAD	_	क्षेत्र हो पर बन्ने कार्		222 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2																
	,		140	~	T SALE LE LE SE LA																
FX FX FY FY FY FY FY FY FY FY FY FY FY FY FY			S		_ \$															<u> </u>	֚֚֚֓֞֝֜֝֝֡֜֝֝֜֝֜֝֝֡֓֓֓֓֓֓֡֜֝֡֡֡֡֝֡֡֡֝֡֡֡֡֡֝֡֡֡֡֡֡֡֡֡֡
Fx FO H C E Fy State	30		1 2 2 2 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1																		
	0 % 0		श्रुवा उन्न स्वाप्ता जिल्ला	,	3 035 551000																
		Ä,	3-4 8 8 7 8 G - 12 G -	4.3	120 45 2 2 3 4 5 6 7 6																

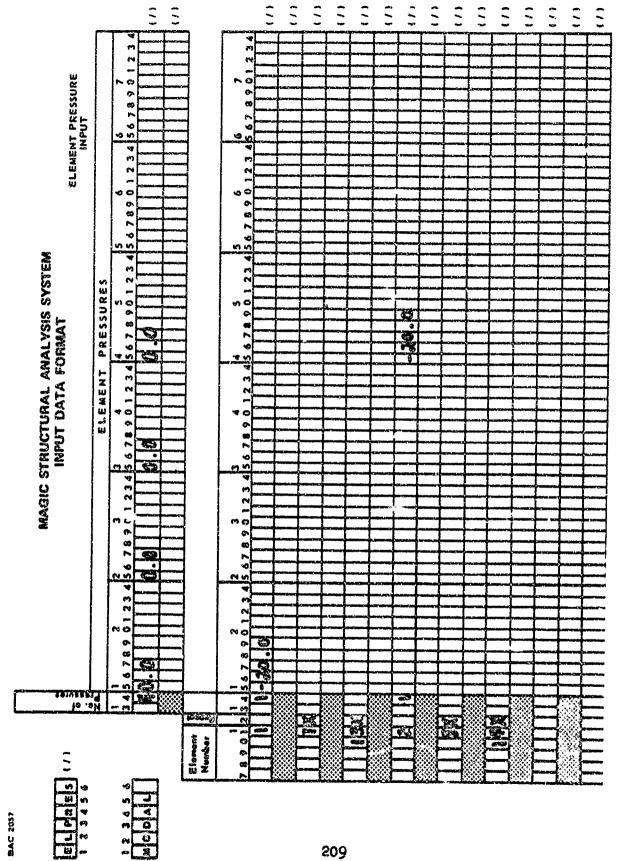
一十十十十十十二

MAGIC STFUCTURAL ANALYSIS SYSTEM INPUT DATA FORMAT

ELEMENT CONTROL DATA

		-		-	ومتنعو	-	_		وستتسر			-		₁	-	-	_			-	-		_
	**	F:	-	-														-				·	-
]	-					-																	
	-	8	-						-			-											
((1	-						-	-		_	_				-		_				
	-	6	-																-				
		3	~						******		-								-		-		
1 1	õ	1	_	-																			
	er.	100		_	 																	1	
	-	77		_						-	-			-	-			-	-	-			
	G G						-			_		_	1									1	
1	•	80					-															<u> </u>	
60		a	-	-				-	-		-	-	_	-			-					1	
-	8				-					_	-					-	_				-		
2		-	}				-			_					-				_		~	1-	
	***************************************	1-6	ļ.			~~~	-	347			- Cappar				-	-	-		-		-	-	
	100	- 5				_	-		-				_							-			
0		-	 -		~~				_														
		+ **						-	-		-	_		-		 		-	-			1	
		77				_	-				-												
	•	-	 			_				<u> </u>	-				-								
	-	50	·	~~~	-		_		-		***			-	_	_							
w		6		_									-			i		1	Ĺ	i			L^-
٥	l "	1	ļ		-		-	-	<u> </u>				_			_		Γ					
0		十六	Q		ď	85	O		UT.	.3	7.5	6 20	1	-	18	0	100	10	10	-]	
2	•	10		=	400			L		-		33			-	-	-		200	960		7	
-	•	10	-	-	-										_		_	1		_	_	1	
		1	6	O		7		4	. 5	17	30	1		48	9	*	80	1	-	J	1	7	٠,
		10	سكنة	=	=		-	-2	338	-	-B	-	-حت	60.00	***	-		-	-	-	1	1	E
1	•	1 7	}	 		-	-		 -	├						 -		 			1	1	国
	-	+=	3	13	F	8	377	7	3	T	3	3	607E	0,0	10	-	a			Can	1	7	Ã
	N N	10		-			=			-	~		520		1		600	1	-]	EL EMENT
Į	! "	6	 		•]	덬
1		1 80		64	60	-	R	3	त्र	1	W	9	3	8		970	3		60			1	z
	-	-	1	1						1		-		-		994		0,020		-	Γ_	1	Ö
	1	200		-	-									r			7	1	1	}	1	1	Ĕ
			4	í	e i		1	I		L	L	l				<u> </u>			_			-	
	SOCON	1	-	-		-	-	-	-		-	-	-			_	-	_			1	7	团
	ea to .el	18																					HE
	ea to .el	18		3	3	4	3	50-	24	7	3	3 -	*	35	#	1	#	7	3	7			RAHET
1689	Tedmby Manal In of Re- Incom	E 4	3-	3	3	æ	3	\$2°	a-	±	3	æ	7	2	*	I.	3	3	*	7			TRAHET
1689	redmby land Ma land Ma	333	3	3	3	Ŧ	3	52	af:	3	3	#	7	**	#	II.	3	1	3	7			PETRAHET
1689	tin: yedeny Mines eA fe .el	33 3 3	3	3	3	Œ	3	\$2	af:	2	3	3	7		*	I	=	1	3	*			TETRAHEDRON
30	TEGENT TEGENT TEGENT THE SE	33 3 3	3	*	3	4	3	32	af:	3	3	≇	Ŧ	3	2	12.	:1:	*	3	*			- TETRAHEI
30	tin: yedeny Mines eA fe .el	33 3 3	3	3	3	8	3	\$\$*	產	3	3	2	土		#	32	i i	*	*				ı
1689	fini fini fini vedmir Mineal	33 33 34 38	***	**	3	4	3	\$\$P	æ	3	3	3 -	走	2	*	32	3	**	7			-	ı
30	TEGENT TEGENT TEGENT THE SE	33 33 34 38	***	3	3	3	3	\$P	æ	3	3	≠	#	3	*	12.		*	3				ı
PRINT	Anoli (moli (moli (in) (in) videnty (A fe .e)	3 3 3 3	*	*	3	4	3	3.9	af-	*	3	3	7	3	a	12	*	*	*	*			DATA -
PRINT	fini fini fini vedmir Mineal	30 33 33 38	*	3	3	3		32	₫.	3	3	3	*	32	3	12.		***	3	*			DATA -
PRINT	Yala Yala Jala Jala In Tedent Vedent	20 33 33 34 38	3	3	3	F	3	2.0	af.	2	7	*	*	3	4	32			*				DATA -
PRINT 6	Anoli (moli (moli (in) (in) videnty (A fe .e)	S S S S S S S S S S S S S S S S S S S	3	*	3	3		200	a	2	3	*	7	3	4	7		3	7	*			DATA -
PRINT 6	real real real real real real real real	S S S S S S S S S S S S S S S S S S S	3	3	3	4	3	32	a	3	3	3	#	3				*	*			**************************************	NTROL DATA -
PRINT 6	mailtead solution and solution	7 28 28 38 33 33 34 38	3	*	3	G.		39	a	***	3	*	<i>*</i>	2	*	3.2	.						CONTROL DATA -
THINT SE	mailtead solution and solution	671 28 28 30 31 32 31 38		*					4		3	*	*		3	3.2			3				CONTROL DATA -
THINT SE	mailtead solution and solution	5 6 7 25 20 31 32 34 36	3	*	33	4					3	*	3			3.2			4				CONTROL DATA -
THINT SE	mailtead solution and solution	4 5 8 7 28 29 30 31 32 34 38		*	93					2	3	2						*	3	9			CONTROL DATA -
THINT SE	mailtead solution and solution	345877 28 28 30 31 32 34 38		*	3							3						*	3				CONTROL DATA -
THINT SE	mailtead solution and solution	22345877 28 29 30 37 32 34 38		*									.					*					CONTROL DATA -
PRINT 6	mailtead solution and solution	22345877 28 29 30 37 32 34 38		*					4		3		.					*					NTROL DATA -
TNIEST TAINE	TANA TENANCE OF THE PERSON TO	01.2 314 5 877 28 20 30 37 32 34 38		*					4			*	-			3.2							CONTROL DATA -
TNIEST TAINE	TANA TENANCE OF THE PERSON TO	01.2 314 5 877 28 20 30 37 32 34 38																					ELEMENT CONTROL DATA -
TNIEST TAINE	mailtead solution and solution	19 01 2 3 4 5 67 7 28 20 30 31 32 34 38	3	3	2	*	2	र्व	2	ż		*			**	4	*	1	*				ELEMENT CONTROL DATA -
ett moli tu tu	Cost on the cost of the cost o	8 19 01 2 3 4 5 6 7 28 20 30 31 32 314 38	7			*	2		2	ż					**	4	*	1		2			ELEMENT CONTROL DATA -
ett moli tu tu	Cost on the cost of the cost o	78 19 24 12 33 4 15 8 77 28 20 30 31 32 34 38	7	3	2	*	2	र्व	2	ż		*			**	4	*	1	*				ELEMENT CONTROL DATA -
ett moli tu tu	Cost on the cost of the cost o	67 8 19 101 12 13 14 5 617 28 20 30 31 32 34 36	3	3	2	*	2	र्व	2	ż		*			**	4	*	1	*				ELEMENT CONTROL DATA -
ett moli tu tu	Cost on the cost of the cost o	5 8 7 8 19 01 2 3 4 15 8 7 1 28 20 30 32 33 4 38	3	3	2	*	2	र्व	2	ż		*			**	4	*	1	*			╸╸╸╸╸╸╸╸╸╸╸╸╸╸╸╸╸╸╸╸╸╸╸╸╸╸╸╸╸╸╸╸╸╸╸╸	CONTROL DATA -
ett moli tu tu	Cost on the cost of the cost o	4 5 6 7 8 19 01 2 3 4 5 6 7 2 28 20 31 22 314 38	***	3	2	*	2	र्व	2	ż		*			**	4	*	1	*			╇ ╸	ELEMENT CONTROL DATA -
eri Tring 10	A Costlon Cost	345678 19 01 2 345 677 28 29 30 33 33 38	3	3	2	**	2	4		2	- P	*	***		***	*	***	1	*	2		┦	III-C.8 ELEMENT CONTROL DATA -
eri Tring 10	Cost on the cost of the cost o	7345878 19 0112345877 26 20 30 31 32 34 38	7	3	2	**	2	4		2	- P	*	3		***	*	***	1	*	2		╸	III-C.8 ELEMENT CONTROL DATA -
eri Tring 10	A Costlon Cost	7345878 19 0112345877 26 20 30 31 32 34 38	7	3	2	**	22	4		\frac{1}{2}	- P	*	*		***		***	1	*	2		╸╸╸╸╸╸╸╸╸╸╸╸╸╸╸╸╸╸╸╸╸╸╸╸╸╸╸╸╸╸╸╸╸╸╸╸	III-C.8 ELEMENT CONTROL DATA -
O O O O O O O O O O O O O O O O O O O	A COTION OF THE PER A PE	0117345678 19 01123145677 28 29 30 33 33 33	7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7	3	2	\$ CEO	2	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2		2	*	*	*	*	***	*	3	1	*	2		╸╸╸╸╸╸╸╸╸╸╸╸╸╸╸╸╸╸╸╸╸╸╸╸╸╸╸╸╸╸╸╸╸╸╸╸	III-C.8 ELEMENT CONTROL DATA -
O O O O O O O O O O O O O O O O O O O	A COTION OF THE PER A PE	0117345678 19 01123145677 28 29 30 33 33 33	\$ c \$ 1	3	2	\$ CEO	22	4		\frac{1}{2}	- P	*	*		***	*	3	3	*	2		▗ ▃▃ ▗ ▗▃▗▗▗▗▃▗▃▗▃▗▃▗▃▃▃▃▃ ▗▃▃▗▗▗▗▗▗▗▗▗▗	III-C.8 ELEMENT CONTROL DATA -
O O O O O O O O O O O O O O O O O O O	A Costlon Cost	0117345678 19 01123145677 28 29 30 33 33 33		3	2	\$ CEO	22	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2		\frac{1}{2}	- P	*	*	*	***	*	3	3	*	2		╻╸╸╸╸╸╸╸╸╸╸╸╸╸╸╸╸╸╸╸╸╸╸╸╸╸╸╸╸╸╸╸╸╸╸╸╸	ELEMENT CONTROL DATA -

Page.



ELEMENT PRESSURE INPUT - TETRAHEDRON ELEMENT, JANTILEVER BEAM III-C.9 FIGURE

MASIC STRUCTURAL ANALYSIS SYSTEM INFOT DATA FORMAT

CHECK OR END CARD

FIGURE III-C.10 END CARD - TETRAHEDRON ELEMENT, CANTILEVER BEAM

PAGE 1

SEESTANCE EDIT SOURCE

TESTF064

48844989 48844989 488449994 488449994 488449994 488449994 488449994 488449994 488449994 488449994 488449994 488449994 4884494 4884494		123 1742 4 176 1742 4 176 1742 7 176 1742 6 176 1742 6 176 1742 6		46884446444464444444444444444444444444
STATECS ARRIBING MITMOLT PRESCRIBED DISPLACERENTS O G G G G G G G G G G G G G G G G G G	POZM 13 X 31 LMT AND 43 X 32 LPCORE WOR WASERDOWN TO WASE	ASSEMBLE STIFFESS FATHER AND ELEPERT APPLIED LOADS RELA ** ER ** ASSEM** ST** (10) FYGLE ** ER ** ASSEM** ST** (10) L'OCALE-GOADS ** NO ** SE JOIN** (10) ** STANFE CHARMER ** NO ** SE JOIN** (10)	THE STATE OF THE S	TL. TIGAGE - ILEANISMENTS IN C. STIPP. MEGEL. T. CAMBE TROS. MILE. ST. C. C. C. C. C. C. C. C. C. C. C. C. C.
နိုင္စမရလမှလည္။	- W##	930 90 -211 		# # # # # # # # # # # # # # # # # # #

4837366
ä
Ξ.
œ.
ď
INSTALCTION
\mathbf{z}
=
ų
Z
ï
=
2
₫
۵,
ABSTRACTION
3
Ē
3
æ
ñ

PAGE

MAGIC AE Test magic

70	REGASHITANO	REACTS - KELA-MILTO NO
71,040	REGETS. SIBT. TLOAD	AEACTS AEECTS. SIBT. TLOAD
10 80	SHULLAS BE TO BO	18 (DIFF.MILT.) BG TO BO
	Kecasker Bects. 318 Pales & 96	Kecasker Bects. 318 Pales & 96

DEPLACEMENTS.	FURTHER
PRINT MEMBER APPLIED LCACS, EXTERNAL LCACS, DESPLACEMENTS.	RESCUEDES AND INVERSE CHECK IN ENGINEERING

×		R SPEACE SECOND
opredictions of the property of the prediction of the prediction of the property of the proper	ELECTRICA NAVE 3 DEGREES OF FREEDOF	OR BUT 4. 10FR - C.F.Z. C. META-C.F.L.C.F.S.S.C.FB 3FT M.A. CRESSIVE 4. 10FR - C.F.Z. C. META-C.F.L.C. C.F.S.C.C. S.C.C.C.C.
i		-

## 3114 4: 10 FR . O. F. L. C. META . C. F. L. G. F. S. S. C. F. R. C. C. C. C. C. C. C. C. C. C. C. C. C.	10.00120 10.00120	tes and repers
10 CREEK 4 R.	SPA INTERNATIONS OF SPACE OF S	SENERATE STRESSES
~ د		UU ·

Raber

DARACTE

FIGURE III-C.11 CONCLUDED

212

뭐뭐

MAGIC - MATRIX ANALYSIS VIA GENERATEVE AND ENTERPRETLYE COMPUTATIONS

MGIC

MAGIC PROBLEM SPECIFICATION DATA

SRUN-

60

MAGIC ABSTRACTION INSTRUCTION LISTING

DAME 1

SINSTRUCTION SOURCE

1 JALIBOOXLDOTROOKELOFTELOSELOSTELOSÉSCOEMOS OFFICIALES DESPLOSTROPER TROSCOSMOXLOFOSO CAMALECCIOS DE CONTROLES DE CONTROL

FIGURE III-C.11A .ANALIC. ABSTRACTION INSTRUCTION LISTING

EIGHTEEN ELEPERT CANTILEVEREC BERN SUBJECTED TO A PRESSURE LOJO. TETRAHEDRER ELEPENT IDER. 40.50 STATICS ANALYSIS.

REVISIONS OF MATERIAL TAPE

ASTERISK OF PRECEDING NAVERIA. LOCATIFICATOR INDICATES THAT INPUT ERECK BETWING WILL NO RESULT BY TERRILATION OF EXECUTION

28 3030 ECE 40 2x. 312528£ 00 09 30900Ee-e-92 392535 66 6-1325226 66 DIRECTIONS. BIR IC TIONS OF MANAGER SO C. Basser go POISSON'S RATE)S REGIDITY MONGEL SMEUT COOK 27 0.4208924-09 MATERIAL INDITITION STEEL CONTROL OF STEEL CONTROL OF THE TRACE PROPERTY PRINTS OF STEEL CONTROL PROPERTY PRINTS OF STEEL CONTROL OT STEEL CONTROL OF STEEL CONTROL OF STEEL CONTROL OF STEEL CONTROL OF STEEL CONTROL OF STEEL CONTROL OF STEEL CONTROL OF STEEL CONTROL OF STEEL CONTROL OF STEEL CONTROL OF STEEL CONTROL OF STEEL CONTROL OF STEEL CONTROL OF STEEL CONTROL OF STEEL CONTROL OT STEEL CONTROL OF STEEL CONTROL OF STEEL CONTROL OF STEEL CONTROL OT STEEL CONTROL OT STEEL CONTROL OT STEEL CONTROL OT STEEL CONTROL OT STEEL CONTROL OT STEEL CONTROL OT STEEL CONTROL OT STEEL CONTROL OT STEEL CONTROL OT STEEL CONTROL OT STEEL CONTROL OT STEEL CONTROL OT STEEL CONTROL OT STEEL CONTROL OT STEEL CONTROL OT STEEL CONTROL OT STEEL CONTROL OT STEEL CONTROL OT STEEL CON C. 3CONDOE OS 80-300050°0 OI ARCTIONS DI PECTICAS MUNICIPAL STATES 30 39999CE 06 27-2500059-03 SHITE PROPERTIES TROPERATURE TEMPERATURE

tetek and matereal data output – tetrahedrok Karonet, cantelever brah FIGURE III-C.12

40. BERECTIONS a 3 CHO. BEGRESS OF FREEDOM 3

	### ### ### ### ### ### ### ### ### ##		•	200	雙重集		ઌ૾ ૢ૽ૼૹ૽ૢ	! 	• କ୍ରେକ	924	使电缆	电频电	₹ ₹		a.e victor III-c.13 toc	
	ě è	604	346				ěěd		***	• • •]]]		665	த் ற 6	6 4	46.0
463	189788ATURES	୍ଟ୍ରକୁ କ୍	· • • • •	4 Ó 6		# @ @ @		4 9 9	1994 9895	0 4 6 4 6 6	900 ***	8 9 9	* 9 *	*****	କୃତ୍ୟୁ ପ୍ର ଜନ୍ମ କ	4 to 4 to 4 to 4 to 4 to 4 to 4 to 4 to
GLIDHING SATA PECINAGEAP CARASHATES	TO Secondancio	18.3 96886895 °8	C.3686essee 43	10 300000000000000000000000000000000000	10 340000000	-6.3600000E #1	Ke sessesser.	-6.3009C090E 02	TO Bosspanners	10 3900000000°G	A. 300000000 01	C. SCHÖRBEC: 01.	-S. Sessente or	19 300000000-0-	-C. 20000000 01.	-6,34ñècese 52
5		ä	ä	8		#	Ħ	8		g .	¥	8			Ø.	*
,	# · · · · · · · · · · · · · · · · · · ·	- 0.700000a	- 6.1430060ëE : 62	- 6.23 09000E	3	- C. 73880886E	-6.1436966	-4.21800/per	3	- C. Teaconour	-6.1446866E	-0.21 coolt	3	-6.Teecoeds	-4.14969568	-0.21 6966 00
	20	3	=	7	3	5	#	=	#	5	2	10	2	10	=	#
	**************************************	-6-286363666	-5.200000E	-6.2860900E	-6.2006968	meessess.a-	30000298°C-	38666362°8°	31:202050X1G	9. 29660 62.E	C. plessed	C. L'SESOCIE	9.E. 30.8E	8, 2960965.4	C. 2008BUCK	G. Z BONDOCE
`	# 10 m	44	A	•	¥A.	•	*	•	•	3	13	2	23	**	52	2

ACLASARY COMBITION LATORAGICS

MD. OF TROS	化学的现在分类型的现在分类型的现在分
ME. OF DEES	电影电影的电影电影等的电影等的影响的 图像像像影像影响的电影
REPORTS OF FREEDOW	,
inegangs c	^{का} जो जो जो की को को को को को की की की की की की की की की की की की की
	की वर्ष क्यों को की वर्ष का का की की उन्हें को की की को का
	带色草色绿色色色绿色色色色色
#DBE3	明的秘密公司 (1) 医甲基甲基苯甲基甲基甲基甲基甲基甲基甲基甲基甲基甲基甲基甲基甲基甲基甲基甲基甲基
	2

TOTAL NO. GLEMENTS . 18

යි ම් පුදේදෙදෙදේමුදේදේමුමුදේදේල් දේශය සියිය සියිදේදේමුම්දේදේදේ	MAN
	TETRAHEDRON REBNERT, CANTILETER
**************************************	erente,
	CAMBEDRON E
	j.
	First Minima Description
のままでは、まままままままままままままままままままままままままままままままままま	
を の の の の の の の の の の の の の	
ののできるとはなるなられるとのではな	
1 まなままな事をのを集下さる以中に	FIRE
	e di
	3
2	
THE SHE	
MACCARE A STATE OF THE STATE OF	
· 在下面面的心理中的自然的心理的。 · · · · · · · · · · · · · · · · · · ·	

ELEPENT PRESSURE TANCE

LIST OF PRESSURES

43. OF PAESS.

E. 67

			-0.2000000 02	-8.2888695 62	-0-2000008 02	9 6	0,20	0.0	000	940	0.0	**************************************	9:0		6*6	600	## *** *** *** *** *** *** *** *** ***
			9 .	0.0	9	0.0	•	9.0	0.6	9.0	0.0	0.0	9	. 9.0	9 ,0	30	9 ,
		,	0.	0.0	0*0	0 *•	0.6		0.0	•••	0.0	0.0	0.0	&	0.0	0.0	9.0
-8.20000E 62	-0.26900E 62	-0.200036E 02	9 3	9.6	• 4	9	9	.	3.6	• 3	•	5	***	•	ෂී	• •	*
-	8	-4	•	•	•	4	•	•	•	•	¢	•	•	•	•		*
6)		2	N	•	3	œ,	•	8 1	21	17 •	Ŗ		2	9	3.6	28	%

element presint table copput - terrabilidade element, cantilever bean FIGÜSE III-C.15

	*
	m .
	ai
	0.16005000E. 0.1
	*
	₹
	- '5
	3
	0
	\$.
	3
	3
	W
	8
	9 .
	ELEPENT LCAD SCALAR a
	₹ ₩

	` ₽
	.
	8
~	
	5
٠	E
LOAD HO.	
٥	5
8	***********
~	
	。

18	•	Trensformer extension as empled load column	es ende ad Load Column	,	-
		46 x 1			
9 °\$	***	O O			á
***	4	***		9	3
•••		3	9.8	•	Ş
•	••	9	0.0		
₽ o \$	8.4	3	9,0	•	
•	6.	8°6	9.0	**	99
•	D .	906	200	3	
. 00	6.	. B . 6	₩•	***	***

T-2ERC FOR STRUCTURE'S O.S

FIGURE III-C.16 TRANSPORMED EXTEREAL ASSECTION LOAD COLUMN -TETRAHIDRON EXEMENT, CANCILLINE SEAN

		888	385	2 2 2	2882	3 3 3 8	2223	858	888	888
			का का हा	200 a mark	E 2 2 2 2	2000 2000 2000 2000 2000 2000 2000 200	200 200 200 200 200 200 200 200 200 200		85 KB 80	
		11252 & 235955 & 1352 & 35	256822 23692 25692 2561 67	14 53 6 12 55 6 15 6 5 5	3369686 4672.996 8233.986 93693.06	22222 22222 242660 14074	2000 00 00 00 00 00 00 00 00 00 00 00 00	13691 at 67527 65 1312 635	7363 91 18252 61976	233370E 231265 353266E
		369	2004	2 N D	9999 8488	2 2 2 3 3 4 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5	9 9 9 9 8 8 8 2	349	8 4 6 0 8 4 4 6 0	2 6 6 2 6 6
		7 7	777	7 7		8 0		0 70	3 4 7	1 0
	FORCE	2 4 4 2 4 4	34 W W & &	8 F 4	8 6 8 4 4 4 18	4 4 4 4 4 4 4 4	**************************************	4 4 60 19 10 10 10 10 10 10 10 10 10 10 10 10 10	a die N	の様で
36		6 6 C	9 0 0	0 0 0 2 0 0	8 0 6 6 8 4 4 4	4 F 7 9	8 6 6 6 8 6 6 6	0 9 G	0 0 0 # # # #	3 9 8 5 4 4
>		2.25 2.88	6 5 W	69 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4	光光光の	3. 表表点 新聞開發	2000年 2000年		200	当業署
6			2000	.26173 -10080	0.279033 0.139263 0.13963 0.13963 0.13963	1000 m	0-10-11-11-11-11-11-11-11-11-11-11-11-11	0-17258 0-20177 0-11258	6.3369) 6.2366(名の世
2		900	9 0 0	000	0 000	0 6 60		0 3 4	606	10.10.10.00 M
3 15 E	FOR CE	4 NA 4 N	4 16 18	4 MM 4 M	e sen	4 D 4 B	4 9 4 16 4 18	~ 50 60 60 60 60 60 60 60 60 60 60 60 60 60	P 00 40	₽ Ø @ Ø ≫
	_	8 6 M	8 4 8	288	8 8 8 8 8 8 8 8	6 4 4 4 5 5 5 5 5	5 8 8 6	325	808	585
		36.00	4 2 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3	200 200 200 200 200 200 200 200 200 200	\$-66.4 6-66.7 6-71.07	8 25 20 25 20 20 25 20 20 25 20 20 25 20 20 25 20 20 25 20 20 25 20 20 25 25 20 25 2	2 6 4 7 2 8 4 7 2 8 4 7	2 2 2	4 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5	4 2 2 2
		2000 2000 2000 2000 2000 2000 2000 200	2244	175806E 224607E 261779E	262729 282228 282285 282385	26922 236822 236822 23636 750363	109900		. 2267925 - 2267925 - 2267925	24467 24467 25457
		9 6 4	6 00	2 6 9	9 8 90	0.28682 0.28682 0.133282 0.38282	6 500	-0.261730 -0.255281 -0.185283	* 6 6	0.224450 0.224450 0.224450 0.22450
	FORCE	*=#	" 38	កដង	A 028	n -25	н өдд	o <u>89</u>	• 4 %	• 49
		883	388	900	# > 0 = 0	9 6 8 8 6 8 8 8	6000	3 33	335	500
		2 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4	60 00 00 00 00 00 00 00 00 00 00 00 00 0	827	4444 4446 4446 4446 4446 4446 4446 444	2 2 2 2 2 2 2 2 2 2 3 2 2	4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4	25 CE	24 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4	2 44 4 2 44 4 2 41 41
		232545E 242546E	1366981 1128201 759157	2825666 2825668 5937728	8728	236.02 x 226.532 226.656 307.22	780286 26174 791867 869598	226362E 2617798	284212 1125286 7501678	1201001
_		કે ફેંફે	d d 6	हे ते हैं	ရှိ ရုံ ရည် လို အို ရည်	તે એ જ હો બ ઝ બ બ	्र देवें के	है देख	4 44	9 9 9
9	325	54 &	es 65	44 G)	64 Pr 68 Pr					
8	5	***	M 00 m	***	≟ €	るすなの	N 1-13 63	60 M 60	- A.A	\$ 14 E
Š		588	838	858	83883	38585	88888	5 38	388	888
cutar		6, 4759 T.T. 6, 1512 C.T. 3, 3369 LOE	0. 2369165 0. 1361 645 0. 5967122	. 6. 643215E 0. 1455 ES	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	-6-11252@ -6-27466@ -6-23696@ -6-33696@ -6-3361	-0.1312636 0.176236 0.322568 0.325568 0.1237636	4.6(1017E 6.2758622 6.2713822	112520 153276 075286	0.1222636 0.6077136 0.1069688
		1512 CM	3369102 736166 5367122	7663.24E 64301.55 1483 EEE	9.603026 6. Tail 24e 8. 2233625 6. 2359536 6. 1513 635	6-1125268 6-2746046 6-2369646 6-3369646 6-3341 672	0.1312 636 0.1760 348 0.3244 636 0.3245 546 0.1397 636	\$. \$41017E \$. \$7566E \$. \$2138E	11252 00 1523 145 0732 166	0. 1222 EXE 0. EUTT 13E 0. 1093 EER
		ල් මුස්	હ નું ફ	ල් ඉ්ල්	- 06030148 - 01931246 - 0233422 - 02354525 01812635	စုံ ဗ်ပိဗိုရီ	ရို ဝီဆို ဇီမ	4.40	200	စို ဧရီ
	SOCIE	~ • §	m 46	a ag	∞ಂ≃೧ ಡ	- 0215	~ *##F	400	* * *	***
	Œ	-	3	A	•	so.	49	~	69	•
						219				
		6909	9210	***	011	8 5100	6.	e.	4 6 6	8
		6	20	6	24 50	6		esse	8	SEE 1

FIGURE III-C.17 STIFFERES MAIRIX OUTFUT - TETRARDHOM ELEMENT, CANTILEVER BEAM

		88	8	đ	88	38	20	21	9	80	8	× 4	3.5		8	3		3 8	8	8	8	88	3	;	8	3 8	3	3	88	ಶ	
		69 (7 60 1 50	S.	(L) (ર્સ હત તે ક્રા	80 80 81	986	<u> </u>	***	30	5	H K	}	8	8	9 6	ě	9		3	- 4		!	ш.	14 C	9		(A)	ğ	
		0.112328	1245	756540	112552 BE	6	38488	12866	200	11252	30 16-925	9	440		129320	15000			10438	34422	2200	8 8 3 4 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8	755A 87E		1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	2243	4 3 4	346.4	0. 13252 BE	1407	
		0.13	3 A 3 d	0.7	8	ంద్ కోత	3	200	1 00	0.21	ď (5 4	j e	5	å	å	ŝ.	i d	ð	200	2	Šø	8	i		કે દ	}	ď	ŏ	ž Š	
		\$				*		•		*	1		9 8		6	6	î	\$				} 9				8 1	ì	•	ţ		
	Porce	84 9	9 M 4 N	æ	त्र अ ?	4 56 4 56	ŔĴ	15 (14 (Ą	63	Ø 9 ≈4 :	₽ €	4 (1 4 (1	;	හ	A)	(P) (4 K	例例	40	-\$* (# S	(A)		*	P) #	e e	4	N	M M	
90	ž.	2,	2 M W		*		19		₩ 1	20	9.	4 5	2 20		w	(Dec. 1)	6	9 F	1 150	•	est i	2 P.	~	9	,		1 (2) 2 (2)	8	8	₩ 4	2
		**	138 200		S. S. S. S. S. S. S. S. S. S. S. S. S. S	2	84		# #! = 0	EM.	S.	្ស ដ	LA AS	120	16.5	5431	- 	k k s a	i Hi				H	a i		_	X 14				
≯		**************************************	6 H 4 H 6 H 6 H 6 H 6 H 6 H 6 H 6 H 6 H	438	20		1.2	TOURS OF	3005 THE	# R86	0.287932) is a second	38	.22433	838		8 4 5 6	3.590T72	4239	100 (E)	STOREST OF	35.28		2660	10000000000000000000000000000000000000	3 500	.22434ZE	000	13691 CE	1
9		24000	000 000 000	0.2349	0.23		9890	Et.O	3 2	88.0	200		300	200	0.22	100 M	20 C	10 T	6.9	0.84	en (7 P		a (2.5		0.29	74		m fr ff g fg G	•
		1		•	9		0	3		3	9		7		1	ï			Ĭ	•	ï	8 8		•	8	1	<i>.</i>	Ū	0	ï	•
5 H	FORCE	*	0 N O	*	NE	9 69 178	4	4	9 V	•-	89 (est c	2) P	9 C	P	\$ 10	10 1	N (4 64	e eq i en	*	(A) (10 E	20 1	7		N #	4 6				
เก	S.	63 8	200 00	<i>4</i> 78.	.	A 24.	æ	Δ.	e0 8m.	69	6 3 (44	- 20	•	m.	12 4	R) est	o ann	•	sa t	is 47	***		53	esi e	9 63	•	16	ಕ್ಕಾ	a
			2 0 0 2 0 0 3 0 0	833	0 6 0 6		24.5	445	25 26 E		8 C							96		*			i S S S S S S S S S S S S S S S S S S S				1 M	(2)	111	ការ ខ្លួំ ខ្លួំ ខ្លួំ ខ្លួំ	
		282286	766123E 336910E	224607	2000 2000 2000 2000 2000 2000 2000 200		104869	100	401964	.262566	Do 122528E	NO TO	9 6	8	3409	600	10 C	10 40 60 0 50 0 50 0 50 0 50 0 50 0 50 0	9	100869	120003	2	8. 126357 E	***	131703	161	2263626	140568	2	2054	?
			7661 3369	22	- 1888S	0 m 4 m • •	200	44.	2	25.	100 (100 (N.		336%	.2246	98.	10 d 10 d 10 d	400	Ä	3	7	10.	7	3	A T		2	. 14	DESC.	200	•
		Ó	1 6 Q	o o	0 9	90	9	40	9	0	0	9		6	q	9	9	7	8	9	8	•		ř	9	3	0	Ÿ	å	ę ę	
	FORCE	on ,	និស្	69	e (1	er)	1	12	æ	#	38	i e	82	ø	#4 T	3:	18	24 26	4	2	88		*	*	S	3 20	9		10 X	2
	Ē								•					• • •					-					,							•
		9 4		0	000	3 (3)		***	2 & C	90	50			8					8				3				\$\$			6) 6 6) 6 6) 6 7) 6	
		22.00	1 60 60 1 60 6	3658	91.08		383	303	266	5286	603	Ž		8	868	182	Š	100	38	507E	3	į	39.5	9	1123282	946	8	67521 BE	137	8000	Š
		112528	3 55 (5)	-0.20236	10 m	31.00 L+6.0	G-224606	C.2386078		112		,	4 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6	0.235 6596	0.262565	220			2495888	0.224607	00000000000000000000000000000000000000	0.00 to 0.00 t	40000 P	783	2.5		1973CDE	8	25	このななのののことのとのなっています。	1
0		6	366	န	d'	3 d	ģ	3	ခို ဇီ	đ	ę (3	နိုင် 	ģ	Ģ	đ	ල් (30	3 3	ģ	3	ઉ ન	6	8	\$	ð e	8 6	9	ő	ද් ද්	•
ઢ	GACE			~	96	ስ ናዋ	м	#	3 (2)	en.	٥.	0 =	~ 4) pol	8 /	0	n () (. 0	en.	ect (.	2	refs (3	9 4	3	49	48	\$ 50	7
ą	£ 69	•	4 M M		(m) #	4 (4		# 0 (N R		+4 (na ¢	Y A	1 199		-		VR	t PA		7 41 1	**	N	4		ri f	4 P			ri F	•
Š		8	358	B	9 6		8	5	3 5		ô							36		3	8	38	3	3			38	8		56	
CUICE		200	328	2	0.2204065	9.22.83.82E G. 22.63.82E	8	1		80 80 80	C. 5.31.263E	ÿ	A 64	爱	825	比	1	Co Medical	18	88	315	i i	2	A R C	200	G-000000000000000000000000000000000000	E E	220	2	0.440448E	\$
		e. 26236%	-0.1323E	0.2343628	2296		3235506	- 8. 95184TE	369624°0	6. 1623 65E	31.2	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	2	O. 26177	0. 2263 BZE			60.00	0.6239106	0.923996	O. Letolie		B. 7.617 P.		9-67921EC		2617785	0. 2263 BZE	- C. TSOI STE	9 4	à .
		6	် စုံ ရှိ	0	0	66	ø	8	j	8	8	3	90	ő	ð	d	3	80	ě	6	0	8	60		8	9	6	e,	ટુ	0 0	•
	80					•														-				-					•	•	
	Frace	# ·	°28	~	9	a na	6-4	*	28	*	•	i ş	38	R	•	80	~	13	200	49	9	ij (R	š '	30			ĝ.	CT)	M 8	Į.
	_	6		rd r0			23			8.8					4					5				;	9			11			
												• •	_																		
		A		<u>Ģ</u>			A			<u> </u>	;	22(U		9					•					<u>a</u>			Φ.			
		0138		0830			9139			4320					9210					45					9			8			

FIGURE III-C.17 CONTINUED

PAGE

		838	5 8 8	2222	588	3 :8888	88588	5.8888	888
		8 F 6	641 448 MA	37.00 3.00 3.00 3.00 3.00 3.00 3.00 3.00	976		24534E		en man
		14-48 13-48 12-63 13-63	111654 267932 1112528	£ 25 5	7636	336909E Versege 535283E 187342E 187342E	52562	7502 876 7961236 1283 676 38796 076 2240 046	2245 821 111 8548 1789 1 48
		9.00	000	2 4 4 4 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6	299	6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6	9 0 0 9 0 0	46499	8 8 8
	w	•	, , , , ,		, ≈.⊙≎			- •	
	FORCE	4 22	228	ままである。	พีพีพ	8 2 2 4 K	のに思想は終		2 kg
96	-	000	2000	0000	0000	0 00000 0 00000	9 C C G B G	8 0 0 0 0 0 0 # w # # # # # #	9 9 9 9
> •		出来に	2 2 2 2 3	はなる。	12 12 13 13 13 13 13 13 13 13 13 13 13 13 13	10.042404 10.042404 10.042404 10.040404 10.040404 10.040404 10.0404	以 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	2 5 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	15730W 261779E 155504E
2		0.9361 0.13121 0.7301	1.368896 1.31283 1.26296 1.33283		- 7 0 6 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1		6.33691 0.14958 6.44594 6.32696 0.24998	0 . 2 . 2 . 2 . 2 . 2 . 2 . 2 . 2 . 2 .	
117		0 00	9996	9 9 9 0	9 9 9 9	0 0 0 0	မှ ဝရုနှစ် မှ	ဝ တိ ဝ မို လဲ စု	0000
SEZE	ice B	22.3	(>n en	0 66 66 46	9 8 8 8 4 4 N 8	4 22 P. 22 A. 4	542424 ちごろうり	**************************************	₩ N & Ø
49	FORCE								
		# # # # # 0 000	# #\## 0 0 0 0 2 0 0 0	居 事 新年 0.000 6 点の 6	m.m.m.m 2002 2003	8 8 4 8 4 8 4 8 4 8 4 8 4 8 4 8 4 8 4 8	6.00000 6.00000	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	# W. W. W. W. W. W. W. W. W. W. W. W. W.
		349963 672014 131263 393648	5235561 112528 226362 812526	149588 413108 112928 224607	3.590772(3.149588 3.2286038	0.221179 0.2243 0.2243 0.2243 0.3123	6.1995 6.726 6.726 6.726 6.736	(159197 (171797 (171797 (171797 (171797 (171797 (171797)	2617711 224382 112528 116528
		M CHW	522		\$ 37.23 \$ 37.23	N. N. N. N. N. N. N. N. N. N. N. N. N. N	200 E		
		9 0.0 9	9 9 9 9	စ ်စိုင်	9 9 9 9	၀ ၀ ရာ ၈ ၈ ၁	9 9 9 9 9 0	• 0 0 0 0 0	မ် ငရီဝ
	FORCE	n sin	" ដល្ល	*****	n san	คสสหลล	" 经被款额税	~==	• 482
	•	\$ 555	* ~ * ° ° °	5 6 6	5 358	0 1 2 0 9 d	72722	80868	7.00 C
			MA 121 MI 411	W1 W1 W1 W1		114 Ma Ma Ma Ma Ma			M4 544 M4 444
		750187E 224606E 3930A2E 419769E	3369108 1286036 1782596	.590772E .224382E .224667E .232569E	.750107E .750187E .261779E	336910 1956256 112528 2263826 3617466	453910E 112526E 1763642E 5135653E	13912836 2384296 2384296 1266636 7301676	334910E 346539E 12663E 675219E
		4 9 9 9 4 9 9 9	6 C C C	\$ 6 9 9 9 9 9 9	5 4 2 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4	99999		4 6 6 6 9 9 9 E E E E E E E	
9	er)		• • •		•				• • •
	FORCE	4 64 W	これなれ	N 55 56	4 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6	Supplier of the supplier of th	u Su onn	4 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	* 224
	_	8888	8888	85888	8888	888888	885888	38888	888 8
CUTOFF		# 025 # 65 # 65 # 65 # 65 # 65 # 65 # 65 # 6	35 H	0.326910E 0.166042E 0.224382E 0.224608E	0.262546E 4.368556E 6.167667E 0.104869E	22222	0. 33401 GE 0. 1495 GE 0. 1702 SARE 0. 225 GE 0. 225 GE 0. 255 GE	# # # # # # # # # # # # # # # # # # #	6.209889E 0.261779E 0.393062E
		0.24179E 0.128403E 0.136347E 0.131263E	6.2359 6.1651 6.1349 9.2625	-0.328910E -0.356942E -0.224382E -0.224382E	0.262346E 0.368846E 0.263667E 0.264864E	0.2030106 0.923336 0.1118546 0.1296036 0.2623666		0.1512136 0.1997725 0.1936473 0.469304 0.194684	6, 2017 795 0, 2617 795 0, 3530 625 0, 527 1375
		0.24179E -0.128403E -0.138367E 0.131263E	- 0.2359996 - 6.165123E 0.3349696 0.3525696	9 0 0 0 6	0 900	- 0.203010E 0.52333E - 0.111854E - 0.12563E 0.25566E	0.1495 08E 0.1495 08E 0.19284E -0.2240 08E -0.2246 08E	40000	6000
	6.3 6.3	~ 222	~ 1122	- 2222	~ 258	21 44 25 15 15 15 15 15 15 15 15 15 15 15 15 15	2244	~ * 220 0	••===
	FOACE				~ (40)			व्य सह स्थ <u>ु</u> हा	tes s.A
		2	2	2	12	ដ	2	Ä	*
						557			
		9830	4810	9220	610	69	9123	4 5 7 8	
		8	Ø	Ö	Đ	C)	5		3

FIGURE III-C.17 CONTINUED

			* # #:	480	9 2 9	4 4 Pr	388	8888	528 3	8358	252
4			### \$ \$2	5 2 S	8 2 8	286 286					
			353868E 111.854E 495013E	41 976 96	. 23491 de . 2750726 . 1382896	85351 6 354926 7501 66	149388E 7962.20E	33491 66 2625636 2617 798 112522 66	146790E 112520E 14956E 1866E	2000000 2000000 2000000000000000000000	## 1 B 2 B 2 B 2 B 2 B 2 B 2 B 2 B 2 B 2 B
PAGE			\$ 60 00 00 00 00 00 00 00 00 00 00 00 00	4 6 6 6	366	20.00	223	2 4 3 4 2 4 3 4	4222	2432	31%
•			750	11	757	770	11	777	-1-1	0.00	777
		FORCE	# 4 V	45 B	* 40 M 10 M	122	4 20 M	4 4 4 W	2 N S S	なる事業	新公司 的外的
	R		0 000 0 000	000	000	8 6 6	# # # W	0 0 0 0 4 0 5 6	2220	8000 8000	960
	>		495886 495886 495886 495886	# # # # # # # # # # # # # # # # # # #	.0.20901GE 0.92355@ 0.11252@	# P C	F 78	0-166649 6-1637749 6-1637749 6-1637749	6.0044100 6.10446600 6.10466000 6.10466000	0-2427345 -0-1823333 -0-1823333 -0-1837536	4.241748 6.241748 6.3362148
	36 8			.1312 .1263 .2246	2 % % A	7.33688.8 7.224607 7.254821	0.261777 0.1048 0.147386	a com	40000000000000000000000000000000000000	**************************************	
	m`		0000	9 00	0 0 0	900	6 0 0	0000	9 9 9 8	9.00	***
	37	e e	~ 886 €	P- VI ·	海岛岛	5 M M	M 74 M	4 14 4 4 14 14	* # # *	4 40 4 4 NNA	2 2 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5
	215	FORCE	·	ผีพี	PH 84 (F)	24 M 10		m 14 14 th			
			8000 9000 9000	8000	28 8 9	555	388	3853	2000 2000 2000 2000	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	282 282
*				1207022 7301076 122603E	262566 2263828 6439168	-0.750187E -0.262565E 0.226382E	3-596772E 3-224607E 3-262779E	3.242568 3.243828 3.4439168 3.7441258	5522	3.5907726 5.224606 5.13243 5.178806	8-191### -6-171#### 8-1714##
			146568 446945 750187 875219	2000	2 7 7 5 2 7 7 5 3 7 7 5	736	200	222	7303 6.265 11.25 2266	393772 224636 131263 176636	
1 44			ဂို ဗိုဝိဇို	၀ စ်ပုံပုံ	6 00	600	909	ဝ ၁ ရ ဝ	0.000	9990	4 9 9
STIFF		FORCE	* 288	****	288	287	282	2222	2222	13.88.8 13.88.8	368
×		ğ				. ,,					
pat ri X			0000	0000	000	900	0 6 6	\$ 000 C	2 9 <u>9 9</u> 2	8 6 6 0 8 5 5 6	### 628
_			6.1407906 0.1125286 6.513643E 0.224382E	-0.7591876 -0.1312836 -0.1493888 -0.7501876	0.336910E 0.242565E 6.786124E	-6.590772E -0.112526E -6.224606E	-0-14-498E 4-26256E 0-176596E	335910E 34256E 323556E 336446E	398772E 112526E 224480E 336698E	1479058 1382638 1040696 2244068	
			11252 11252 51366 22438	2000	35.25	8 7 7	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2		2 2 2 2	1 man	11224 91221 12221
	•		3 000	9 9 6 6	ક કહે	404	¢ • 6		ပို မိမိ မိ	9 0 0 0	3 44
	9	2	n mm 4	# M M #	12.00	110	2 0 0 0 2 0 0 0	222X	1222	2283	333
	•	80								-	
	CUTOFF		2 2 2 8	2 8 8 8 2 8 8 8	8 8 8	868	8 2 5	\$2823 Bunnan	2882	28882	2 # S
	S		0162 0163 0163 0163 0163 0163 0163 0163 0163	191203C 199046E 196147E	200	336910E 750167E 136698E	2.44 2.44 3.44 3.44	2000 N	5 4 5 5 4 6 4 5 6 6 6 4 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6	20000	1973 836 2417 786 2243 336
			0,13691C3 -0,837024E- -0,224362E- -0,224606E	0.1912630 0.3936466 0.2617796	. 6. 2359596 6. 1912636 -0. 3349106	6,3369 6,7361 0,1366	0.523546E -0.658691E -0.224606E	0,2259595 0,131265 0,224362 0,275612 0,131263	0.13896 0.750187 0.242565 0.514969 4.756186	6,523550E 6,126703E 6,124504E 9,730124E	6. 1573 48E 0. 2417 78E 0. 2243 52E
			9000	9 9 9 6	9 90	6 6 6	0 0 0	9 2 6 9 9	0000	00000	
		PORCE	**22	4082	228	ដូងម	2 2 2	22822	22022	22224	222
			2	23	2	2	8	# 6	×	2	\$
								555			
			<u>a.</u>	6	Ġ	A.		6.	8	& Ø	<u>e</u>
			9310	4810	esta	*820	510	4810	6 9 27 8	8	9539

FIGURE III-C.17 CONTINUED

			#-2	2		į
PACE N			ARTERIA .		20 20 20 20 20 20 20 20 20 20 20 20 20 2	
ā.			*	4		
		PROCE	なが	er (
	Z	~	* pc		₽ 49 40	
	***		0.13452.00 0.7563.07	20 YEAR	# 344 C	
			** **	783 ≥ €		F
	ない。	TAN CE	out part		はおき	
dering artist as			D. ATETICAL CO.			the section askins
#11% #		S NAMES	编辑	* :	48	
in a va	•		-0.2/2/2/2000 00 -0.1/2/2/2000 00	California de Ca	4.1 7.2 2.2 6.4 4.1 7.2 2.2 6.4 4.4 2.2 2.2 2.7 2.7	-
	. 6.0	F DRCS	t c			
	ă.		88	3 1	RAE	B
	Cuttie		9. 27. 12. 12. 12. 12. 12. 12. 12. 12. 12. 12	#77##67*9 ·		
		324	2 %	3 :	2 % 2	į
		***		6	Ř	

DERP

ANIO

Cantago THEAT 日に

** **** CHEST CA 电影红耳 数据中

***	於母 班里斯里里里里	A STANASTIC	** ************************************	TO WILLIAM OF		***	•••	2	· · · · · · · · · · · · · · · · · · ·	10 · 中国中国中国中国中国中国中国中国中国中国中国中国中国中国中国中国中国中国中	A. M. P. C. S. C.	於學 · · · · · · · · · · · · · · · · · · ·	9 7	8 00	2	4 * 0
*	e 4	8	c d	*	0.3	9	0.3	9	0.4	63	ē	D. **	9	2	***	***************************************
N.S.	8-8	9	0	***	**	8	a 3	6	***	6 6		9.0	6	**	8	6.4
	**	N	内	*	兴	18	•	#	4 2 53	200	**	ä	a	落	Ä	Ä

はいな #X 228 OPERAT OF MARKET LOADS - TETRANDECON MEMBER. MEL MATRIX MATTER LOADS

Trans Teles

ri

VACTOR III-C.19 MAINIX LOADS - TETMAHEDROW MINIMUM, CARLILLY DE BEAN

\$ 5 \$ 5

. . . .

	•••	-6.51588572E-64	-0.12094015E-03	-0.25 SECOND	•••		-0.12367318E-03	-0.38385648E-03	0.0	-E-30294657 E-04	-0-12696861E-03	-0.19824316E-03	0.0	~3.50296454E-04	-0.12429131E-03	-0.10e971.98 E-03
*	9	-0.24304804E-04	-6.33360448E-Ó4	-0.35343779E-06	0.4	6.15122647E-04	6.20197197E-64	6.20220969E-04	6. 0	-6.19332758E-06	-6.226200608-06	10-3252136279-		C. 24177219E-04	6.32450443E+64	d. 31 % c7356-04
3	0.0	6. 11979973E- ga	6. 3623 CSGR- 4.	0. 5632 82 865- 69	9,9	C. 91729371E- CS	6.2732759E-W	0.471348412-84		6. 14999443E- CA	6.29959934E-04	0. 50579053E- 04	• •	0-111550336-04	0. 28593638E- CA	0.47979382E-04
n de n	~	~	39	4	••	•	-	e 225	•	\$	ni i	' 2	\$	\$	51	2

DISPLACIBURT MATRIX - TETRAKEDRON KLINGHT, CABILLEVER BEAN FIGURE III-C.20

Z	G. 18773509E GA	0.25634766E-01	0.57 061328E-61	0.20751953E-01	-0.20247501E 03	8.51369531E-02	30-305295T SE*0	0.1562/360 F-01	-0.145223991E 02	0.23425781E-01	0.95214664E-02	-0-13189594 F-01	0.629438456.03	-0. 10.233906E-01	-0.217209165-01	-6.31250690 E-01
*	6.15606333E 94	C. 36648438E1-88	0. 32224563 2-3 1	6.46£26125€~#B	-4.15485569E OA	-6.17622266E-61	-Calessizese-01	-6. 78125 COC-02	C. Léigeiste Ot	6.58593750E-02	9	-0.63476943E-02	-C.14350553E OF	-0.12397981E-61	-0-124693235-01	C. 2 8452 576E-6E
¥	-0.34702108E 03	-6. [733996e= 01	- 6. 4 805 9363E- 01	-6, 251636666-61	0.3438314E 03	- 6. 9521484E- 62	**	6.881250\$0E-02	6. 2229 5352E 03	6. 292960 P.W 02	-6. 190625662-62	0.20907613E-01	-0.31737466E 03	6. 1651 03-63E 62	6.23437566E-G	6.34662540E-62
A08	~	*	M	*	*	10	•	•	• &	2	#	2	2	2	23	2

FIGURE III-C.21 REACTION MATRI - TETTAMEDRON ELEMENT, CANTILENER ES "

STRESSES FOR THE TETRAHEDRON ELEMENT (STRESSES EVALUATED AT THE BLONGNT CONTACTOR

	LOAD CONDITION NUMBER	NO ITION	NUMBER	ELEMENT NABER	ME F	Alexant Type	Cerent Grid Formts 1 3 9 10	0.03.00	POSINTS 10	
STARES POINT	5	E4978 578 5. SIGM-X 0.49789597E		\$1689~7 8. #9725768E 02	•	REMEMBRAKE Sigha-2 0.4974597E 02	#EHBRAKE STRESSES 1-2 197E 02 +0.17039139E 02	3	51 GNA VZ 51 GNA VZ 0-69 9 12 26 0 26	Signa-in
RESERVE SYRESS POINT	R. ENEMT APPLIED STRESSES STRESS POINT STEIN-X	0 STRESS	65	SIGMA-Y		reachtae Sight-L	oerğanie stresses Segreta O.O		\$1 GNA- Y2	316-318-218
NET ELE STABES POINT	NAT ELEMENT STRESSES STRESS FOINT 3 0.49789997	STRESSES SIGNA-K 0.4978990TE	8	31646-V 20 59272574-0		SIGNA-2 SIGNA-2 G-4919957E 02 -0-3769	20 Bectories 20 Second 20	₽3 3	38 389888889 24 - 183 15.	316.44.318 0.6
									,	

STREES OUTPUT, ELEMENT NO. 1 - TETRAHKUNG KLEMENT, CARTILLINER BEAN

FIGURE III-C.22

STRESSES FOR THE TETRAHED.RON ELEMENT (STRESSES EVALUATED AT THE ELEMENT (CONTROLD)

	Signa-an Constant Con	Min - Single 18	31 CHG-23 G-70 CG-77 E
	21 36667460 24-71015	\$1 644- 72	51676-71 0.44488430E 02
Pushts Be		8	₩¥ •
ELEMENT GRID PUINTS	Stresses S 16812—NY -6-6222417E OL	Membrane Stresses 8.80/r-xy 8.0	Herbaine Stresses Stora-Ny 197e os ~0.62224617e os
GLENENT TYPE	SIGNA-Z SIGNA-Z C-4063-6597E OI -C-6222	Menspane : Septa-2 0.0	######################################
ELEMENT ALMBER	\$16KA~V 6.3842¢776£ q2	\$1694-V	\$1674-7 6-3142077 62 62
LOAD COMDITION NUMBER	Stress Sign of Stresses Stress Signa-X Point O. 2001910/e 01	Stress Applied stresses Stress Point Signa-X J 0.0	MM. M. Chen Stresses Stress Point Signa-X 1 0.240191048 61
	Apparent Stress Point	ELEMENT STRESS POINT	MEE. B. EN STREES POINT 1

228

PIGURE III.-C.23 STRESS OUTPUT, ELEKENT NO. 7 - TETRAHEDRON ELEKENT, CANTILINER BEAM

(STRESSES EVALUATED AT THE PLEMENT CONTROTO) STRESSES FOR THE TETRALEDROX

A STANDARD TO THE PROPERTY OF

	Signe-2x 0=3327539E 00	SECRETE 28	83 GMÁ-1X G. 332275 GO
3.1 3.1	51 6 12.42 0.970864612.01	2A -41,0 18	10 Mosses 15. 24-418
ELEKENT GRID FOINTS	Stresses S1686-XV -0.12101746E 60	517855 EX 5 168 i= x v 0 - 0	STRESSES. S.J. S. S. S. S. S. S. S. S. S. S. S. S. S.
8 <u>,</u> Epen 1776 90	Sight-z Sight-z -0.13503021E 02 -0.12101746E 00	Signate Stresses Signate 6.6	PENSAME STRUSSESS. SIGNAL SIGN
ELEPERT BLIBER	51 GHA-Y. A 31 E 24 A 90 A 90	\$16#A-T	10 316M6-10 0. 564455110
LOAB CONDITION MUSBER	Street C. Chart Streets Street Fold Schools	erent App. 189 stresses Stress Point Signa-X	1057 fr. CAMENT STRESSES \$72 fr. \$21 47 \$1544-X \$ 6.3923 (416-0).

III-0.24 STREES OFFICT, MADENT BO. 18 - TETRABEDROE MADENT FOR BEAM

PICURE

ELEPENT TV PE	9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9	60.23235136E 03 -0.23235136E 03 -0.20338136E 03 -0.2033818E 03	-0.5333252E 02 -0.503332532E 02 -0.533332532E 02	72 - 305-04-57 E 88 - 5-30-20-20-20-20-20-20-20-20-20-20-20-20-20
MOEA ELEMENT ALPBER	-4	FORCES FV 4, 51, 2033296 63 -0, 355439036 63 6, 277648638 63 -0, 396814796 63	**************************************	FONCES FV 6.51833256 03 -6.24905438 03 0.27604658 03 1.27604658 03 -6.3491478 03
LOAD CONDITION NUMBER	~	APPEAR ON CHEMIT POINCES 1 -0.34652494E 63 2 8.0 3 4.26657632E 63 4 6.06154555E G3	Resident Applied Foaces Point 1	POINT PX PACES POINT PX PX PX PX PX PX PX PX PX PX PX PX PX

FORCE OUTFOT, ELIMENT BO. 1 - TETRANIEDRON ELIMENT, CANTILEVER BEAM

	LOAD CONDITION NUMBER	MUMBER	ELEPENT PLPEG	PLFEEF	ELEPENT TYPE	EL EME	NT G	2 %	ELEWENT GRED POINTS	
	•			~	S	8	•	01	e4 e4	
90 121 141 141 141 141 141 141 141 141 141	APPAR ONT ELEMENT FORCES PO 1917 1 -0.16121735E 2 -0.34997579E 3 -0.34997579E 4 0.24690440E	2552	FCACES FY 0.25107715E -0.25107715E -0.251254EEE	ី ខេងជប់	FZ 0.32393629E 02 -0.3762891E 02 0.16310899E 03 -0.1787378E 03					
POINT TALL TO NO.	APPL RED FORCES 0.00000000000000000000000000000000000		6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6		F2 0.6333252E 02 0.0 -0.93333252E 02 -0.93333252E 02					
NET ELE POINT L	MET ELEMENT FORCES POINT FX 1 -0.16121735E 2 -0.3440717E 3 -0.52778320E 4 0.2489040E	ಬಿಕಕ ಡಿ	FCACE S D, 231 07715E C -0, 20782 022E C 0, 821254 89E C	888	FZ 0.12572706E 0.3762801E 0.27644219E 0.84540527E 0.84540527E					
-,-	231									

PICURE III-c.26 PORCE CUTPUT, ELEMENT BO. 7 - TETRAHEDRON ELEMEN, CANTILEVER BEAN

FORCES FOR THE TETRAHEDRON ELEMERT

ELEMENT GAID POINTS 12 e 16 11				
C				
Et a T				
E E				AHEDRON
ELEPENT TYPE 50	FZ -0.10183766E 03 -0.23251953E 01 0.45326643E 02 0.36832031E 02	~ · · · · · · · · · · · · · · · · · · ·	F2 -0.10183960E 03 -0.23.251953E 01 0.65326643E 02 0.368325343E 02	PORCE OUTPUT, ELEMENT NO. 18 - TETRAHEDRON ELEMENT, CANTILEVER BEAM
ELEPENT PLPEES	FORCES G. 25122 P.CE G2 G. 846523 PE G0 -0.46151123 P.C.2 G. 20179195 P.C.2	9 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	F CPCES F Y G. 25122863E G2 G. 94642383E G2 G. 46151133E G2 G. 201791 99E G2	
NUM3 ER	5005		50.00	III-c 27
LJAG CONDITION NUMBER	F. E. EN ENT. FOACE S 0. 20361320E -0.24643574E 0.23112753E -0.48350154E	APPL RED FORCE S 0.0 0.0 0.0 0.0	NET ELEMBNT PORCES POINT 1 0.20361328E 2 -0.24663970E 3 N 0.23112793E 4 W -0.48359156E	FIGURE 1
	POSET POSET B B B B B B B B B B B B B B B B B B B	A EMENT POINT 1 2 3 4	232	

tung di restantanum addit annana na annana na annana na annana annana (1988).

!

D. Triangular Prism

いって これのことのことのことのことのできる

A six element cantilever beam subjected to an end moment is shown in Figure III-D.1. This figure displays the loading, idealization, dimensions and material properties. The preprinted input date forms associated with this example are given in Figures III-D.2 to III-D.9. No comments need to be made with respect to the input for this element since no pecularities exist. The reader, however, should review the input data sheets and compare them to the previous examples for clarification purposes.

The output supplied by the MAGIC III System for this example is described below and shown in Figures III-D.10 to III-D.22. The matrix abstraction instructions are shown in Figure III-D.10. A complete description of these instructions is provided in Reference 5. Figures III-D.11 to III-D.14 show the output data obtained from the Structural Systems Monitor. These figures record the data pertinent to the problem being solved.

Figure III-D.11 displays the problem title and material data output. The gridpoint coordinates, temperatures and pressures are given in Figure III-D.12. Boundary condition information and finite element description is presented in Figure III-D.13. In the boundary condition portion of the figure, zeros ('0') represent degrees of freedom that are fixed (i.e., no motion) and ones ('1') represent degrees of freedom that are free (have unknown values of displacement). The second last column accumulates the number of ones which in this problem is 36. The second portion of Figure III-D.13 shows the finite element description. Each of the six elements is called out in turn with gridpoints, print options and material number. Note that neither extra gridpoint nor section properties are presented since they are not required for this element.

Figure III-D.14 presents the external load condition and transformed external assembled load column. This 48xl vector is the total unreduced load which is read row-wise. The ordering of this vector is consistent with that of the boundary condition table given in Figure 1II-D.13. Note that a load of 66.66667 pounds

is applied at node point 4 in the negative global Y direction. This is position (11,1) in the load vector which corresponds to the eleventh entry in the boundary condition table which is the global V displacement node point 4. The other loads follow the same pattern.

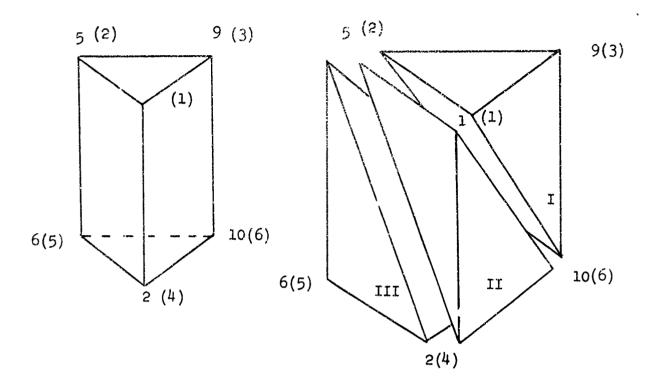
MAGIC III System output of final results are displayed in Figures III-D.15 to III-D.22. Figure III-D.15 shows the stiffness matrix which is presented row-wise and it's ordering is consistent with that of the boundary condition table previously discussed. In this problem the ordering is

The externally applied load vector (GPRINT OF MATRIX LOADS) is presented in Figure III-D.16. This figure shows that forces (F_y) are applied in the negative and positive global Y directions at node points 4, 8, 12 and 16. These forces are numerically equal to ± 66.66667 pounds and are directed to form a moment of $M_\chi = 800$ in pounds applied to the tip of the cantilever.

The displacements of the cantilever beam resulting from the above loads are given in Figure III-D.17. It is noted that the displacements (U, V, W) are output corresponding to node point number and are referenced to the global axis. Figure III-D.18 shows the reactions (F_X, F_y, F_Z) . These are output corresponding to node point number and are referenced to the global axes system.

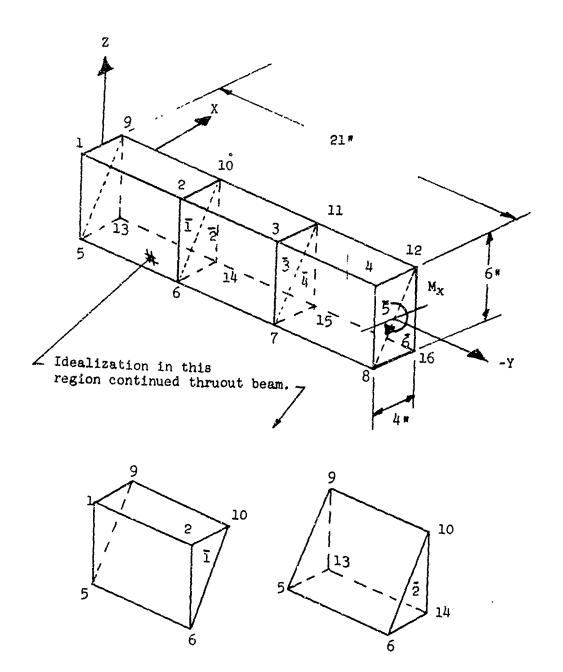
The stresses arising in the structure are displayed in tabular form in Figures III-D.19 and III-D.20 for elements 1 and 6 for example. Stresses are defined at the centroid and are referenced to the global axes for each tetrahedron which makes up a particular triangular prism element. Three stress points are given under each stress category for each triangular prism. These stress points correspond to the stresses in particular tetrahedrons which are defined in the heading of the stress data. The tetrahedron nodes listed are the local node numbering system

and these must be correlated with the grid point numbering system. In the present case, element number one is defined as shown in the sketch below:



The numbers in parenthesis are the local element numbering system (See Reference 7) and the other numbers are global gridpoints. The Roman numerals on the right hand sketch are the tetrahedron numbering system. The remaining elements in the idealization are handled in the same fashion.

The last set of output is given in Figures III-P.2I to III-D.22 and consist of the global oriented element forces. Output labeling is analogous to the stress output except that the element forces are defined only at the six corner points of the triangular prism element. Six force points are given and for element number one for example, force points 1, 2, 3, 4, 5, 6 correspond to element grid point numbers 1, 5, 9, 2, 6, 10 respectively.



Prism #Ī

Prism #2

$$E_x = E_y = E_t = E = 30.0 \times 10^6 \text{ psi}$$
 $\mathbf{y}_{xy} = \mathbf{y}_{yx} = \mathbf{y}_{yz} = \mathbf{y}_{zy} = \mathbf{y}_{zx} = \mathbf{y}_{xz} = \mathbf{y} = .333$
 $E_x = E_y = E_z = 0$, $T_1 = T_2 = T_{16} = 0.0$

Figure III-D.1 Triangular Prism Cantilever Beam With End Moment

BAC 161E

MAGIC STRUCTURAL ANALYSIS SYSTEM INPUT DATA FORMAT

TITLE INFORMATION

THIS IS THE FIRST ENTRY ON ALL REPORT FORM INPUT RUNS AND IT IS REQUIRED FOR ALL RUNS.

REPORT (/)

NUMBER OF TITLE CARDS

				-		-	-		
م م	_			-	}	-			
~ \$									
2	\exists		—			-		 	
~			-	-					
=									
		-			-	ļ		}	
-					-				
rel									
	Š	╼╅╼╼╅					-		
-								-	
	-84					 			
	£	1	-	 	 	 	-		
-	7	口							
	A 2		 	 		 	 	 	
61									
		\Box		7	-		-		
- 0	3	H		1	 		 		
•		14		j					
2	3	1		-		} }		 	
		EMERIT. STARTERS AMOUNS AS							
*	8							 	
		물	\vdash	<u> </u>		1 —	l	1 -	
ᅱ	<u>v</u>	3							
*0	2				 	┨┝╾		▎┝─	
-	B	Till Till		-		1			
~	3								
9	H SUBSECTION	+5	-11		┞╌┼┈	╂╼┼╼		 	┠┈╌ ╂╌┥
4	E								
		Tr.	-	 	│	┥┢╾	│	 ┥┝─	
-	3	F							
5 5 6 1 2 3 4					-	-		-	
	Nek Nek	Z							
~	E					1 —		}	
3					┼╌┼┈	╂╌┼┈		 	├ ── ├
•									
63	\$				<u> </u>	┨ ├──	 	∮	∮
-		25.00				<u> </u>		1	
7	VI.	9							
	1 1		-	-	 	1 -	1 -	1 1	
6	3	- C							
34567	ELEMENT	4			╿╌╏╸	╂╼╂╌	╂╌┼╌	 	
•	W	3							
~	4	147		-	 	┨ ├──	┫ ├─	┨┞─	{
-	11	व				1 -		<u>i_</u>	
-0	SIX	TRITANS OF AR			-				II
Ø.	1	日	 		 	<u> </u>	j	j	j -
-	口								
*	-				 	 	 	 	}}-
*	1 1								
*									
~	 		}		1 -	┪ ├─	1 -	1 -	1
~	j l	, ,							

TITLE INFORMATION - TRIANGULAR PRISM ELEMENT. CANTILEVER BEAM III-D.2 FIGURE

MACHINE SAMES

MAGNE STRIKETURAL AMALYME SYNYRM INPUT DATA PORMAT

MATERIAL TAFE IMPUT

MANUS CHEMINATY				-			**	20 	~	,~ ~ ~	45. 14. 14.	~	Accounts and the control of the cont
A				-	operaris's	-						.	
Š	-35		-		-			-				-	-
3				-		and the same	*****		-		-		\vdash
•	44	1 1 7 6 6		******									
	* *	5 i 5.3 ±	1		-			Samu					
SE SESSE	30				2000		31,444,000						
	2 - 798 :									.	ļ		-
THE LEAST	E -	87			-	****	·	-			-		1
Party Sales	1	waterwell.		*	1			Correction.		Mary Park			
-	-		A MARINE	h		*****	¥	*	****	·		·	*****
Pates saur.	8	8	The state of	42.0244	******				} ~~~		-		
and the rest to the second of the second	***************************************	2 64	11	in marine	-	***************************************	-	•	-	·			1
age? Have		2 4 2 3 2 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3	4	***********	A STATE OF THE PARTY OF THE PAR	to the same							
	0	1 2 4	ALC: NAME OF TAXABLE PARTY.			H-MICH							口
	-	31-	and the second						-				-
PARON BUT	*				*****		-			 	-		1
de la constante de la constant	1	1 7				***************************************							
CANAL TO SERVICE		150											
Same Same	3	SAMPAGE AND	, ,"	7	ř	gerone en	-			-	····		ç ıq
CANNO AND PARTY	0		Marian		******					L			
	American Marie	\$	ALCOHOLD WATER			District Air			ļ	 -		 	-
adentions	#X	1 5	The same of		****		-			 			├ ─-{
	The Marie of the Control of the Cont												
	23	e i sa successiva	-						 	-			}
			12			·			-				-
			Lad										
	-	L me	9 5 • 5	•		L			L	<u> </u>		L	<u></u> i
Š	1	nations/()		3	~								
ICENTIFICATION	7		*										
\$	1	3		Ava	******	***************************************							
Ē					4CB//1040/								
ä		3	N. Carren		-				 -			-	
		1 18	Symme			-	\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\						
MATERIA		6	10	*****									
5		2	-										
3	*	145	À			*******							
	-	westerned.		\$	44 44 44		,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,						
]		1463 -	2 ₩		1		,	3			t
	04 D C#	-:					•					-	1
	*	TABLE STATE	0										1
		NEWTHER TABL											
FOOD COOPS	-318	S S	-			-	l			1		 	l
***********	+#2		-						- -	1		 	ļ
₹ 5	•		MEAN WA				1						
Z ¥	-												1
AATERIAL PLABER	7		71	•	}		į		<u> </u>	1			j
# "	-8	1 2											
Museus	0	MATERIAL PROPERTIES TABLE TEMPERATUMS											
Hedness		1 5	a	ρΩ									
	1	j	2	38									

MATERIAL TAPE INPUT - TRIABOULAR PRISM ELEMENT, CANTILEVER BEAM III-D.3 FIGURE

-

MAGIC STRUCTURAL ANALYSIS SYSTEM INPUT DATA FORMAT

SYSTEM CONTROL INFORMATION

ENTER APPROPRIATE NUMBER, RIGHT ADJUSTED, IN BOX OPPOSITE (/) APPLICABLE REQUESTS Number of System Grid Points 2. Number of Input Grid Points 3. Number of Degrees of Freedom/Grid Point Number of Load Conditions Number of Initially Displaced Grid Points 18 19 20 21 6. Number of Prescribed Displaced Grid Points 23 24 25 26 27 28 Number of Grid Point Axes Transformation 7. Systems 8. Number of Elements 31 32 33 34 35 36 9. Number of Requests and/or Revisions of Material Tape. 10. Number of Input Boundary Condition Points 11. To For Structure (With Decimal Point) (/)

45 46 47 48 49 50 51 52

MAGIC STRUCTURAL ANALYSIS SYSTEM INPUT DATA FORMAT

1 2 3 4 5 6 C O O R D (/)

GRIDPOINT COORDINATE

					ſ								C)	1	R		Ē	(3	T	1	1	0	١	į	S					_			
	rid Nur			ı	T			>	<	_	R				T				Y	_	0				T			;	 Z	_	z				
7 8	9	10	1 1	2		3 4	. !	5 6		7 8	B 1	9	2	1 2		?	9	5 1	 8	7	8	9	3	1 :	2	3 4	. !	 5 6	· 7	, 8	3 9	- (a	4	1 2	,
			L	1		3	Ţ,	0		Ι		Ī	I	I	C				I	I	T	T	I	I	T	1.	1	1	Ι	T	I	T	T	T	7,
				3	Ŀ			.0							ŀ	L		K	1	brack I	\prod	I	I	I	*		1	1	I	I	I	T	I	Ι] ,
			L	3			1	0	1	L	L			L	J.	-	•	١.	. k	2					3		4],
Ш			L	4	Ŀ	a	Į.	0			L				-	ŝ				,											Γ	I	T	Γ	7 (
				5	-	5	l.	0	L				I		0		(I	Ī	T			Γ	Ł		•	e		Γ	Γ	T	T	Τ	7,
				6	Ŀ		١.	0			\prod				-	-	1.	¢		I	I			Ι	ŀ	3	Ι.	e	Γ	Γ		T	T	T] ,
Ш		L		7	Ŀ	3		0							_	1	H					I	\prod		Ŀ	3	[.	0		I		I	I	Γ],
			Ĺ	8	-	3	Ŀ	0							Ŀ	3	1	Į.	K	2	I	I			Ŀ	7-	т-	0	T			I	\prod	Ι] ,
				9	2		C								[C		\prod	I	I				3		C					I	I	Ι] ,
Ц			1	0	وا	Ŀ	0				L	Ĺ			Ŀ	1		C	I		\prod				3		0						\prod] (
П			1	į	9		0						L		_	}	1	H.	0	J	Γ		T	Γ	3		þ			Γ	Γ	T	Γ	Γ] ,
\prod			1	3	J	·	0						L		-	3	1		. 0		Γ	I	T		3		b					T	T	Γ) ;
\coprod			1	3	3		0	Ĺ							0	7	C	1	\prod	\prod					-	3		0					Γ	Ī],
\coprod			ì	4	3		0		L						Ŀ	7	L	¢	1						-	3		O			Γ	I	Γ	Γ] ,
Ц	_		1	5	2	Ŀ	0		L		L	L	L	L	-	1	H		0	ı	L		L		-	3		0		\mathbb{L}		\prod	$oxed{\mathbb{L}}$	Γ] (
Ц			8	6	3		0					_		L	-	3	1		C						-	3		0					Γ		1
Ц							L											L	\prod													T	Γ		١ (
Ц																																			1
\coprod	_	_				L	_	Ц	L				L		Ĺ		L	Ĺ																	(
Ц	_										L							L					L												(
Ц	1																															L			1
Ц	1	_						Ц											Ĺ	Ĺ															(
Ц	1							Ц										L	Ĺ				Ĺ												,
\coprod	1	_						Ш																											(
Ш									_																			1					П		(
\coprod																				Γ								1					П		ı
H	Ţ	T	1	1	1			Π		П								Γ	Γ			Γ			П		٦		٦	П		ŗ	П		,

FIGURE III-D.5 GRIDPOINT COORDINATES - TRIANGULAR PRISM ELEMENT,

CANTILEVER

MAGIC STRUCTURAL ANALYSIS SYSTEM INPUT DATA FORMAT

BOUNDARY CONDITIONS

INPUT CODE - Q - No Displement Alsowd 1 - Unknown Displement 2 - Known Displement

2	3	4	5 6	
0	٧	Z	D	1

PRE-SET MODE

		_	_	_	
1	2	3	4	5	•
	0	D	A	ı	
1-	•	-		-	ı

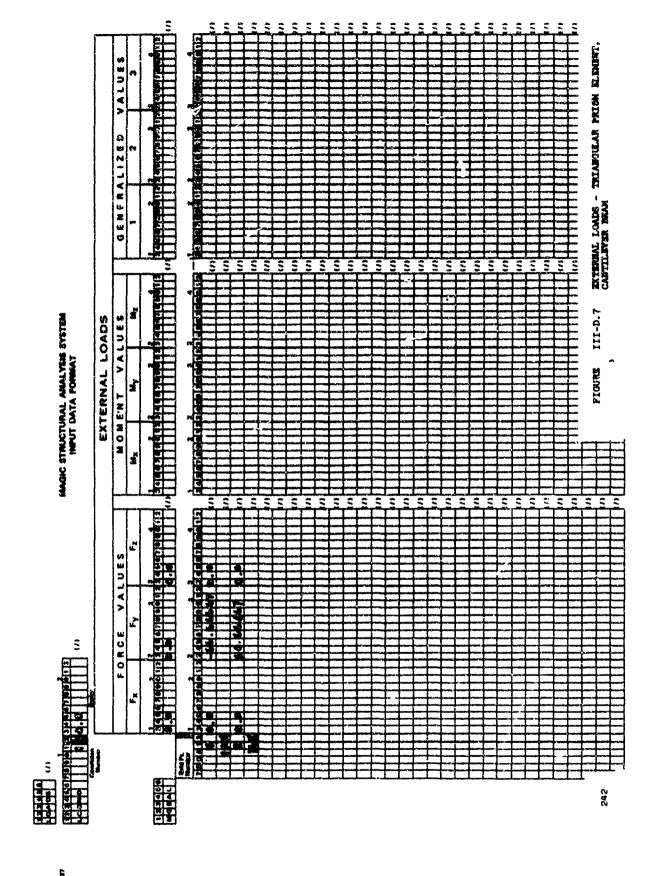
TRA	NSLAT	IONS	RO	YATK)NS	GE	VERAL	IZED
u	٧	W	Θx	97	6 8	3	2	3
13	14	16	19	17	10	19	20	21
	1							

3 (/)

LISTED INPUT

G	Ň	d l	6)	Rt 17										
_		, ,	1	_		13	14	15	16	17	18	18	20	21
				Į		0	Q	(3)						
				5	X									
				7										
			1	3	X									
1	Ĺ													
1														
		Γ	Γ		Γ									
	Γ		Γ	Γ	Γ									
		Γ												
		Γ	Γ	Γ										
	r	Γ	T	r			-							

FIGURE III-D.6 BOUNDARY CONDITIONS - TRIANGULAR PRISM ELEMENT, CANTILEVER BEAM



DNC MET

MAGIC STRUCTURAL ANALYSIS SYSTEM INPUT DATA FORMAT

CLEMENT CONTROL DATA

			۷	3	~	3	7	٤	۵	3	ತಿ	۵	۵	3	ې	>	\$	۵	১	ک	S
	1	1.8																			
		F	 	<u> </u>	-	-	-			-	-					-		-			-
		40																			
	=	L.																		į	
		÷		-	 -	-		-	-				-	-		-		-		-	
	9																				
			-									Ì	Į								
		-12	.	}	-			-										-	-	-	├
	_	**	-	-	1-	-	-	-			_							-			-
•		0																			
-																-					
*		F.					-				_			-	_			-			_
6	~																			_	-
		*																			
		*			20						_	_								<u> </u>	
	1	1	=	-	-						-			-						_	┢━
		90	J	32	1	Œ	(D	C. 3													
m	•			2	ļ							-									
0	-	-	-		10		-					-		-				Н			-
=	*						-				_										
	_	H	L.	T.	1	12	-			-		_		<u> </u>				-	-	-	-
	_					-					-	-	-				-	-		-	
		ľ			3																
	M .	**						-				_						-			
		8	=	16	4	3.1	1.0								-		-		-		_
	-	2																			
		23						-						-	_			-			
1800	16. of 50	8																			l
Cap	Almost	7.4	5	[S 4.)																
	wiesh											_								-	<u> </u>
	1700	H											L								L
5	.me13	F																			
PRSMT	-	_	_				_	-	-	-	-			-	-		-	-		_	-
	Helte	Œ											.								
100	Elea. Inc	8																			
	sentati		-			-	-	-		_	-	-		-	 			-			
· weigh	Pioces A ministra	8	•																		
		_						_										 _			
•	, <u>w</u>	6.	-			-							-								├
MATERIAL	ERPERATIOE	÷							\vdash												
	2	•																			
		-2	 -		\vdash								}			-		-	-		
3		7 1											-	-	-						
1		11.0	-																		
**	191160	2	9	3	J	J	•	9					1								
	Maq:elal		_		Į		•	3													
	n Hagaadal			_			-														
\$		4												- 1	. (L
Į į		49										-	 	-	-	-					
1007		4																			
7.6.614.	MUNICIPAL	3 4 8 6 7																			
		3 4 8 6 7				18															
	MUNICIPAL	3 4 8 6 7		138	1	1858	1 1 1 1 1 1 1	1155													
, O	E POTA	6 6 1 2 3 4 8 6 7		188	35.1	1828	1 1 1 1 1	1157													
, O	E Frne	0 12 2 4 6 6 7		1384	194	1828	188	1157													

ELEMENT CONTROL DATA - TRIANGULAR PRISH ELEMENT, CANTILEVER BEAM III-D.8 FIGURE

MAGIC STRUCTURAL ANALYSIS SYSTEM INPUT DATA FORMAT

CHECK OR END CARD

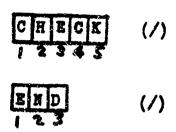


FIGURE III-D.9 END CARD - TRIANGULAR PRISM ELEMENT, CANTILEVER BEAM

TESTEO04

,是是一个人,我们是一个人,我们是一个人,我们是是一个人,我们是一个人,我们是一个人,我们是一个人,我们是一个人,我们是一个人,我们是一个人,我们是一个人,我们

y ka

TEST MAGIC

85 S
S PRINCE NOW S

• •						16516049 16516049 16516050 16516051
STATECS INSTAUCTION SEGUENCE	#	11 = SC.IDENTC. 13 = ILANUL. SC. UIFF = IL .SMALT. SC.19.18 ASSCHOLE STIFFHESS HATRIX AND ELEPENT APPLIED LOADS	KELA = EM .ASSEM. SC.(10) FTELA = EM .ASSEM.SC.(40) LSCALE,LSADS = RID .DEJOIM.(1.1) REMUCE STIFFMESS MATMLS AND PRINT ROCKED = WELA .DEJOIM.(SC(5,1),1)	F = KNG.DEJOID. (3C (3.1).0) RCE.DISP) STIFF REGGE	Thin sydem Extense LCADS TC 0-1-2 ASSEMBLED SYSTEM LOAD - TRANGLIANDS ROAD - FRELSANDELLOAD TO FRELSANDELLOAD TO FOR ON TO THE SAME SERVING TO THE SAME SERVING TO THE SAME SERVING TO THE SAME SERVING TO THE SAME SOLVE FOR ON THE SAME SOLVE FOR THE SAME SERVING TO THE SAME SOLVE FOR THE SAME SAME SAME SAME SERVING TO THE SAME SAME SAME SAME SAME SAME SAME SAM	XX = STIFF. ME GEL. TLOADA NEO-WALZ = Wa.OE JOI'N. (SC(5-1)-1) X = WIZ. TWA. T. XX XO = N. M. C. Y.

FIGURE IXI-D.10 MAGIC ABSTRACT INSTRUCTION LISTING - TRIANGULAR PIGURE PRISM ELEMENT, CANTILEVER BEAN

and the state of t

TEST MAGIC

TASTRESS	TESTE 094	TRSTEORY	76576658	TESTEOS9	TESTE 040	TESTEROR	7.55 T.E. 06.2	TESTEGGS	125 1104	TESTE 06.9	7ES7E064	TESTE 467	TESTEBES	TESTEGAS	TESTEBTO	TESTERT	TESTEO72	TESTEOTS	75575974	TESTE 075	TESTEO74	TERTEGIT	TESTEORS	16316079	TESTEDED	TESTECAL
u	REACTS " MELA.MELT. NO	REACTY RECTS. SUBT. TLOAD	17 CONT. M. CO. 10 10		- VALIDARY APPLIED (LACE) MINERAL LICENS PLACEMENTS			C REMEMBER NAVE 1 ON 2 DEGREES OF PRECEDUR		CHARLE BACKBOOK ON SERVICE LABOR OF THE	Grand Share and the Top Top Washing and a second se	GPR 18 17 Ao 12 - Y - 8 - THE TAY OF THE	OF INTELLIBER TO SERVET WORLD IN SERVET SERV	IF (ILAMULL) GO TO 400		C ELENKATS MAVE & DECARES OF PRESOCA		10 SFR 2018 4 FR . 6. FZ. 0. FBE 14. 0. FI. 6. FS . SC . TR . 2FT ELA	OPA BRIC 4 FR. C. FZ. C. PSE 14. C. FZ. O. FB. SC >L CADS	OPR SYTE 2, U. O. N. O. THETAY. O. PO. O. P. O. P.	Cor be to the coff a coff a coff a coff and the coff a coff and the coff a		C GMERATE STRESSES AND FERCES		606 STREET SERVICES STRESS (4.1)	FORCEP-RR. 20 . FORCE. (4.)
	6 10 10 10 10 10 10 10 10 10 10 10 10 10	R:	7						;	¥	n N	*	(A)	3 2				~	2	Z,	2			;		2

PERUME III-D.10 CCRCE.TOED

SIX ELEPENT CANTILEVER BEAP SUBJECTED TO AN END MOMBNT. TRIANGULAR FRISP ELEPENT ICEN. NO. SI STATICS ANALYSIS

PEVISICAS OF MATERIAL TAPE

ASTERISK 10) PRECEEDING MATERIA. INSHTIFICATION INDICATES THAT INPUT ERFOR METUPNS WILL NOT RESULT IN TREATABLE OF EXECUTION

9.333066E CC **BIASC TECHS** DER JE VICINS AY 8.333000£ 00 POISSON'S RATIDS RIGIDITY MODEL! IMPUT CODE 2.2 0.340000 08 50-30**00067**°0 11 6.300600€ 09 7.7 0.696000E-45 DI RECTICAS DI PECTICAS MONE'S POULT M. EXP.CGF. 0.30000E CS ** 0.69000Œ-CS MATERIAL PROPERTIES TENPERATURE TEN PERATURE

247

TITLE AND MATERIAL DATA OUTPT: - TRIANGULAR PRISH ELEMENT, CANTILEVER BEAM III-D-III FIGURE

0.0

** 325221.0

6-112526E 06

23 6.3350ese 40

Profession of the feating from the state of a second

Andrew Constitution of the constitution of the

ţ

Homester and spiritely was property and the state of the

The same of the sa

16 REF. PCINTS

MO. DIRECTIONS - 3 AC. DEGREES OF PREDEP - 1

till some in the Bones

24000

																															III.D.12										
	PRE PSIMES																														FIGURES.										
		0	9 C	•	•	6	C	6	0,0	0 0	9 Q	0-6	•	0 • 0	0 0		0	0	9.0	a (9 6	9	0	0.6	0.0	9 6		0	0.0	0	0.0	0.0	0,0	9	3 :	က္ (0	000	o,	o č
	TIMPERATURES	907	0.0	3	9.0	45 G		90	•••	0.0	27	9	8	0 4	0	29	9.0	3	9.0	9.0	? ·	• •	3.0	0.0	0.0		000	9.0	0.0	0.0	0.0	Q. O	9.0	Q.) (D 6		0,0	0.0	0.0	0.0
oat a Cogreinat es 1		· ·																		•					91			• •		5			9.			₽€					G.
GRIDPOINT CATA		0.3000000E 01		0.3000000000000000000000000000000000000		A. Messecont A.			0.3000000E GI		-0.3000000E 02			-0.30000000E 01		TO SECTION OF ST			-0.3000000E 01		S. Schoonsons as			3-30300000E 01		0. 100000000 01			0.300000006 01			-C. 300000000E 01		100022000			-0-3000000F 01			-0.30000000E 01	
5				5		8	,		8					3		ŧ	ŧ		3					70		G.	l		3					ť	73		8	š		8	
	>	S		- 4. 7600006BE		-6-340ABOROS			-6.21960600E		9) }		- C. 70500405		- 0. 1 LOBERED S			-C-21 00060CE		ę			- C. 70000060E		- 0.140006ccF			-C.21 CO0000E			o o		00000000000000000000000000000000000000			- 0. 140000CG			- E. 21 0000000E	
		10		70		ē	;		70		62))		-		ë	;		10		03	;		5		Į,	;		Si Si			2		ě	: }		10) }		ē	
	**	-0.2000000		- 3. 2000000E		-0.2000000E			- 6. 2000000E		-0.205009906			Xecopopop		- 6. 2000000dg			- 9- 2004//000E		G. NOW CONTROL			6,200000E		900000000			0.2000000E			0.20000006		300000	3000000000		C. 20000000E		1	5. 20000000E	
	THE OF	~ 4		~		,	•		*		07	,		2	48	•	•		•		•	•		2		100 100 100 100 100 100 100 100 100 100	•		12			.		*	•		81) }	į	*	

GRIDPOINT DATA OVYPUT - TREAMCHEAR PRIEM ELENERY, CANTILEVER ENAM

SCLADARY CCAPITICA INFORMATION

MO. OF TWOS	0000000000000000	
HO. OF CNES	ひきか くかでませる ままかり ちらら ちょう ちょう こころ できる	•
		TETAL NO. BLEKENES =
DEGREES OF FREEDOW		TETA
の氏を発性なる	⁷ सम्बद्ध के सम्बद्ध स्टब्स्ट के सम्बद्ध	
	िंग को को की भी को नो नो भी नो एए को भी को नो नो	
	② 4 전 12의 4 전 2 기 4 전 2 제 4 제 2시 ② 4에 4에 4시	
400M2	आ ला का देश को का का का का का का का वा का का ना ना ना ना ना	01.5

RTIE Seemen	0.0	G.	o o	0,0	9•6	•
SECTION PACPEATIES	ဝ ခ်	c ප්	ာ	0,0	o d	ŝ
	ç	9	9	9	٥ ئ	ර
EXTRA GRID PTS						
GRID POINTS	9 ~ 6	**	10 3 7	10 7 15	5 7 22 4 8 12	11 8 16
ڻ ه	•	•	•	•	•	•
PRRT	Ü	•	0	0	•	•
TEM	9.0	ලේ	6,0	3	03	0 0
200		•			•	•
MAT MO.	æ	***	bra bra	rs.	,1	put
% *-			× 20	16 4	96	1 51
8			. •	•	_,	•

FIGURE III-D.13 BOUNDARY COND". ION AND FINITE ELEMENT DESCRIPTION - TRIANGULAR PRISM ELEMENT, CANTILEVER BEAM

· was above contrated with the con-

LOAD NO.

ELEPENT LCAO SCALAR = 0.0															
OF LOADED MODES 16	ð	03		667E 02	đ		3	0 6	ತ	క	8	đ	ક	3	4
4046ER	0.0	22 0.0	0.0	16 0.0	0°0	0.0	9 0.0	0.0	0.0	4 0.0	0.0		11 0.0		

TRANSFERPED EXTERNAL ASSENDLED LOAD COLUMN

	3	3	9	••	3	3	3	ö
	0.4	- 6.666699第 92	0.0	Q. 66666952E Q2	0.0	-0.6446699% QX	0,0	0.6686699E C2
48 X 1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
*	0.0	9 •0	0.0	0.0	0.0	0.0	0.0	0°0
	0.0	0.0	0.0	0	e 3	9	•	ÿ*0
	e 250		0.0	0.0	0.0	9*9	••0	0.0

T-ZERC FCR STRUCTURE .

TRANSPORNED EXTERNAL ASSENDED LOAD COLUMN -TRIANGULAR PRISM ELEMENT, CANTILEVER BEAM FIGURE III-D.14

ļ

Market Line

		888	385	888	8888	2882	8888	355	335	388
		52 an	121E 10E	1495 & 6 E 92395 & 6 8966 91 E	33642 06 2123 456 323556 33641 06	134698E 122528E 226607E	6. 2246 06£ 0. 1 31.1 83E 6. 1 0546 0€ 0. 1 4 95 8 3 8	33692 GE 6772 8 GE 1312 636	9 2 E	8 0 4 8 0 4 8 0 4 8 0 6
		0. 11252 8E 0. 235955E 0. 1312 838	-0,256821E -0,334910E -0,7508.07E	7 2 2	33698 32359 33691	448	121	33691 67528 13128	. 7361 926 13252 86 53446 88	3895046 1382898 3933488
		é 56	0 0 0	0 6 6	4 6 6 6	4 444	4944	3 43	9 9 9	9 4 4
	FORCE	a 54	6 2 N	20 C	あむまる およれ	8098 888	8 G R 4	- 25	# 4F	• 677
*	_	6 5 5	900	3 9 0 w v u	5 5 5 5 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6	9 9 9 9	9 9 5 5	~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~		000
>		2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	X 33 5	1. 25 1. 25	0.279672 0.131283 0.224562 0.562887	2 2 2 2 8 2 3 2 3 8 2 3 3 3	0.786124E •-443617E •-274664E 0.261774E	発音器	0.33443 6 0.22440 1 0.34364 6	0.35306.E 0.220379E 0.268284E
2		0.52355# 0.336910E	-0.224382% -0.224604£ -0.853914£	-0.261779 -0.104669 -0.149586	0.279072 0.131203 0.724562 0.56288	0.33491(0.796187 0.386254 0.336916	0.7661246 0.443617 0.274696 0.261779	0.17248 9.26277 9.112528	0.33641 0.2246 0.39364	-0.39304Æ -0.22037Æ -0.24828Æ
•••		900	9 9 9	000	8 0 8 0	0 0 0	9 9 9 0	0 0 0	0 9 9	6 6 0
\$ 12 E	FORCE	4 M M	4 66	4 25	4442	4 P 4 W	4 P 4 W	F 55 4	~ #1 #0	7 K 4
		6000	5 6 5	888	8888	3235	5888	888	358	586
		0.786124E 0.224382E 0.203010E	0.22460&E -0.262565E 0.336910E	0.176806E -0.224607E 0.261779E	2617796 1125286 2625656 262565	.199508E .294021E .112928E .750167E	-0.643015-J -0.145566 6.262566 -0.590772E	-6.261779 E -6.226362 E -6.157363 E	588 E 196 E 582 E	.443017E .224607E .261779E
		0.224382	.224606 .362565 .336910	128	. 261779 . 112528 . 262569		6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6	6.22.5922 6.22.5982 6.157303	-0.1495 84 -0.640 196 -0.2243 82	.229407 .229407
		4 9	0 90	000	9990	ှဲ စုံခံ စ်	9 9 6 9	4 44	999	9 0 0
	FCACE	~ = 2	~ = 3	" = B	P=24	~ -3%	n = 24	• 48	* \$8	* \$10
		000	000	228		6 9 9 9	8582	3 53	4 8 6	000
0		C. 336910E -U. 262965E C. 262566E	0.136498E 6.112928E 0.750187E	4.229406E 8.262566E -0.596772E	-0.224302E -6.443027E -2.201779E -3.336910E	-0.2568218 -0.2265828 -0.224685 -0.9907728	-0, 7991862 -0, 201779C -0, 1147532 0, 149564	-4.224362E -6.224379E C.261779E	-0.254421E -0.112520E -0.750107E	-6.750107E C.131283E -0.349563E
0.0	ORCE	2 0 11 0 11 0 11 0 11 0 11 0 11 0 11 0	7 2 12	~ 2 %	W - 2 W	2224	27.22	S 22 2	8 A 8	2 A B
u.	F0	* * * *		w ~ n	•	·				
CUTOFF			2 5 3 2 5 3	*	77 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	**************************************	282 282	8 3 5 9 5 6	## ## ## ## ## ## ## ## ## ## ## ## ##
Ü		0.275072E -0.131263E -6.33691GE	0, 33651 0E - 0, 7501 66E - 0, 9907 72E	- 0.7661246 - 0.6430136 0.145508	- 0.6630146 - 0.7861246 - 0.2359596 6.1312636	- 0.11.2546 0.2246 0.8882 - 0.33491 - 0.7301878	-0.1312836 0.1708066 0.2246076 0.9285960	- 0. 643017E - 0. 39304.E 0. 224362E	- 0. 1125286 - 6. 535504£ - 0. 8752136	-0.131243E 0.607713E -0.145588E
	PORCE	₩ 0 0	~ •g	~ • 2		- 4 INE	ค ค กุ กุ กุ	405	***	405
	€.	er ^a	~	•	•	•	•	~	•	•
						251				
		510	0154	9220	#\$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$	e 22 0	2 2 2	9810	9318	4810

FIGURE III-D 15 STIFFNESS MATRIX CUTPUT - TRIANGULAR PRISM ELEMENT, CANTILEVER BEAM

東 (東) 東京 大丁 下 中 市

~			# 22 52 52 52 52 52 52 52 52 52 52 52 52	# # # # # # # # # # # # # # # # # # #		2 2 2 2 2 2 2 3 2 5 2 5 2 5 2 5 2 5 2 5	# # # # # # # # # # # # # # # # # # #	m m m m m 2 8 3 2 3	858	8 8
PAGE			1 00 to 10 t	6. 4842 546 0. 132 52 46 -6. 2364 076 -6. 4762 46	6, 2246 Deg 6, 2342 gg 18, 2949 gg 18, 7308 g6	-0.11252 BE 6.365434 6.361779 6.364106 -6.244767	-8-868 % E-6-8969 & E-	6.2244076 -6.3780411 -6.4781441 0.2244676 0.4554276	0.1125286 -6.6752138 -0.131283E	- 6. 60% 5 64 E - 0. 2243 82 E
	•	FORCE	经经验证券	****	~ 228	*****	- # # 4 ×	*****	7 8 A	4 8
	8		\$ 0 E O	0 000		90009	3 3 3 3 3	9 9 9 9 9	¥ 77 #	* *
	78 8V		-6.212399E -6.33491G -0.34470%	#9754200 #9754200 #9754000	0.261774 6.256874 -0.224694 0.69962 W	-0.220379E 0.131203E 0.224303E 0.075214E	-0.22534 -0.22534 -0.55962 -0.3561 -0.14954 -0.14954	9-241778 -0-478168 -0-249629 -0-34954	-0.21612% 0.2#114@ -0.33661@	0.22438 XE 0.444213E
	5 52 25	FORCE	4 40 4	20 P	4 20 0	P 2750	0 m d d d d d d d d d d d d d d d d d d	* ** ** ** O	# # C	64
			2 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8	8 5 8 8	2 2 2 2	33333	28282	83538	5 4 6 6	
STIFF / 1/			0.252546 -0.3349998 -0.8752196 -0.3930626	-0.224667E 0.205567E -0.334930E 0.224606E	-0.104869E 0.67363BE -0.764123E 0.349563E	0.262366 0.112528 0.216328 0.706128 0.336938	-0.224605 -0.401104E -0.224696 -0.4792188	0.790194E	0.131283E 0.2409776 0.875213E	.149580E .885610E
		FGBCE	* # # # # # # # # # # # # # # # # # # #	* # # # # # # # # # # # # # # # # # # #	* #2\$	* ###	* ###	* ####	• 552	• 5
74721X				0000	3 8 8 \$	66666		2 2 2 2 2 2	* * * * *	67
	0		9,1125246 0,3654346 0,2417798 0,3369108	-0.262945£ -6.334909£ -0.374194£ 0.875228€	-0.224406 E -0.39306.2 -0.478164 E 0.224606 E	6.162526 -0.216125 -0.22612 -0.22612 6.22612 6.47510 6.91613	-6.24.365E 0.224.302E 0.6736E -0.33610E -0.34690E	-C.224667E 6,261779E 6,224686E -C.241779E -C.446335E	0.112528E 0.109016E -6.393062E C.224382E	-0.875218E
`	0	FCACE	4 2 5 E	N 9 4 6	~ 655	a Sausa	2 2 5 M & W	a 22222	32.0	91
į	CUTON		2 2 2 2 2	2 2 2 2 2	2 3222	22222	58888	3 8 3 3 3 5	5 3 3 5	5 5
•			- 0, 262569E 0, 332203E 0, 224362E 0, 675218E 0, 926620E	0.2243 82E 0.2246 0 TF - 6.0012 64E 0.33691 GE - 0.1695 88E	0.523956 0.1149536 0.2494296 0.3430626	- 0.2629696 0.1312696 - 0.3369966 - 0.8369666 - 0.369106	0.224307E 0.22437E 0.203567E 0.324667E 0.224667E	0.523556 0.4359 796 0.4730 196 0.3095626 0.3095626	-0.479214E 0.131243E -0.112524E -0.786517E	0.224382E -0.299625E
		POR CE	122	~ * 2 2 2 2	- 44 NO	404472	*****	e • 2222	* 50 A	~ Si &
			2	54 e4	2	8	4	21	2	11
			•	•		252				
			6. 97 88	8 8 8	4 210	7 SEO	4510	6 220	OKS P	orce

FIGURE III-D.15 CONTINUED

			888	88	588	33	85888	88888	2222	8588	
			-0.3741946 -0.393062E 0.393962E	-0-33491 0E -0-2243 A2	-4. 579220E -4. 112526 -6. 28%4 60E	-0. 2244 OTE -0. 128403E	-0. 81691 08 -0. 67381 98 -0. 207 4328 -0. 4964 998 -0. 11252 88	-6.34910E -6.34910E -6.14958E -6.31598E -6.31598E	-0, 784.836 -0, 784.236 -0, 391.436 -0, 126.036	-0.224342 -0.479238 -0.409946 -0.112528	
	FORCE		# S. S.	20	= 228	# X	* 2852	* *****	子の生までなる。	さかかの	
36	-		3 0 0 2 0 0	5 6	9 9 9	~ •		0 0 0 0 0	0 0 0 0 0	# ## F W	
36 8∀			0.261779E 0.102469E 0.750187E	-0.875214E -0.128683E	-6.336916E 6.22466E -0.17964E	-0.764123E -6.149504E	- 0 - 1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	-0.39403.00 -0.314400 -0.514400 -0.514400 -0.514400 -0.514400	0.244564 0.244564 0.224664 1.0.224664 1.0.246644 1.0.246644	-0.1972036 -0.2032046 -0.1125236 -0.0752166	
S 12 E	FORCE		# # N	9 %	9 2 2	2 22	4 20 4 20	4 40 50	4 77.77	- 5000	
				283	828	388	2222	25822	85386	2 22 25	
			-0.349563E 0.449213E -0.261779E	0.5235386 0.336969E 0.262564E	0.149596E 0.188062E 0.224362E	-0.990772E 0.189667E -0.699125E	0.33C416E 0.33C416E -0.13C43E -0.13C43E 0.131263E	-0.149588 0.675226 -0.226488 0.226406 -0.675218	0.224606 0.224606 0.724606 0.4475046 0.3495638	0,251779E 0,32603E 0,199340E	
	FCACE		• 51 %	~ 22	****	ក្ខុន	* 2288	~ = = 4 = 4	* IROR	* 2002	
		5	5000	388	388	\$ 28	25852	# # # # # # # # # # # # # # # # # # #	* * * * * * * * * * * * * * * * * * *	25555	
9. 0		-0.196246	-0.750107E 0.281146E -0.349543E -0.196924E	**0.334910€ 6.287982 6.122526	-6.996772E 0.336909E -0.750196E	6. 759197E 6. 224606E -6. 224607E	0.334910E 6.475216E -0.75216E -0.351425E	-4.653910E 6.336416E 6.326406E 6.224302E -6.224302E	-6-790187E -0.391862E -0.39983E 0.189657E 0.224608E	9.336916E -0.353621E -0.37362E -0.577137E	CONTINUED
•	FORCE	58	- 272	~ 22	~ 2 %	a 2 %	4 4 5 4 5 4 5 4 5 4 5 6 6 6 6 6 6 6 6 6	*****	0 9 m 4 n	2 K B B B B	CONT
CUTOFF		8	8228	288	3 2 2	: 23	32222	882858	3 2 3 2 2 8 8	5 35 55	Ŋ
20		\$, 11252AE	6.261799E - 6.478166E - 0.750186E 0.131243E	- 0. 2359 396 - 6. 7942 236 - 0. 1750446	- 6- 39491 @ - 8-2246 866 - 8-5136428	0.262544E -0.34964E 0.52959E	- 0.202910E - 0.32555E - 0.35570E - 0.35570E - 0.67523E 0.2622655	0.134910E 6.14950E 6.138910E 6.178010E	6.191200 - 0.2246 Ost 6.2296 Ost 6.2817 795 - 0.4591 295	0.962007E 0.261774E 0.224362E 0.107464E 0.131263E	III-D.15
	FORCE	*	~ m = 4	-22	-25	- 22	1888	~~1758		*****	PIGURE
	_	17	8 2	2	2	z	2	ន	2	2	
							253				
		015#	otse	6 S T O	\$20	7818	4 516	8. 8.	\$ 516	*	

		8885	5 3 3 3	3 2 2	5 8 8	888	358	5853	388	5 8
			6 8 6 62 6 03 6 07 6	9 6 6	£752186 1129286 2244076	349300E 1312 835 176006	10E	97921 66 3129266 7761 676 25682 1 E	3 2 2 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3	301
		39364 11252 14958 87521	2000	33691	× 52	1312	73.0	97921 2322 77561 6 25682	\$ 25	\$2+61 \$3491
		တို့ ဝိဝိဝိ	ခံ တို့ လို့ လို့	ತತೆ	નું નું નું	377	·6. 33491 06 ·6. 4792 1 8E ·6. 275 972 E	6 4 5 6	6 6 6	6 0
				i i i	•		• •		•	• •
	FORCE	24 C	# 0 4 K	* NR	Z 22	222	222	5 20 E	23	* 5
£	I	******************	~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~	C 6 6	0 0 0		P 9 9 0	0 0 6 0 # # # # #	9 9 0 0	0 0
		表 不用形象		***	2 2 2	***			***	# 8
8		~ ~ ~ ~ ~	0.13528W 0.24956W 0.75016W 0.2461778			0.131281 0.699129 0.226601	123556 123556 12556 112526	-0.3341 CE -0.2360 CE -0.2243 CE 0.2243 CE		.93634
*		0.11292 0.2248 0.5136 0.2243	6 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0.67 0.92 0.33 0.33	0.33691 0.2246 0.83669	757	0.52 0.52 0.11	777	9999	0.0
		9 9 9 9	9999	• 0 0	çç	6 9 0	9990	7770	7777	7 -
3718	FORCE	* 50 mm	**************************************	22 23	8 × 8	228	****	3 222	***	W W
•	5		** ***							
		20808	2 3 6 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8	8 3 8	2888	8 3 \$	8866	# # # # # # # # # # # # # # # # # # #	0000	
		1499881 875116 224382 346494 875216	2222	655627 224362 275072	750100 175044 175044 149508	2 2 3	ひなけた	1111	2222	131283
		\$ 52 % E	2657 2657 2768 2768 2768 2768 2768 2768 2768 276	8572	8543	9403 2246 1179	2221	1381 1128 1128 1128 1128 1128 1128 1128	.9803 .2246 .1495	131
		9 00 9 9	0 0000	400	9999	7 7 7	• 0 9 9	4 400	7 99 7	6 9
	3	- 4858	* 485 x	288	2882	222	n nak	n ner	2222	3 2
	70 P.	- 4008		→ 0 10	~~~	→ R: R	24 74 FA	~ ~ ~ ~	~ ~ ~ ~	~ ~
		3 3 5 5 3	60000	3838	0000	3335	8886	355	: : : :	0 7
		0.453793E 0.336910E 0.750186E C.108253E 6.526610E	0.750107E 0.365061E 0.346505E 6.261779E	386910E 179646 201779E	678294E 112528E 224666E 254821E	.0.1495886 0.2625666 0.3495438 -9.4630178	33491.0E 175044E 261779E	478294 E 21338 8E 224607E 134498 E	149588E 242565E 349342E 174064E	32.00 01.75
		653793 336910 750186 1 08253 526619	13 01 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	3969 1790 2617 1125	678294E 112928E 224606E 284821E	1495886 2629666 3499436 8430176	334911 17504 26177 11791	525 225 225 235 235 235 235 235 235 235	6.14958 6.24258 6.34954 6.27498	1128 430
		4 24 24	व व व व व	3433	1999	9994	3 494	\$ 223	4 2 4 9	3 4
o o	146				-			•		•
	OPCE	n 2244	となりまる	2222	2223	====	ななない。	は はば は	はななが	11
-	14	8 55 5 8	2 2 2 2 2 3	2223	8558	285	5 3 3 3	88438	8 8 8 8	8 8 8
CUTOFF										
J		0.334910E - 0.24828E - 0.875218E - 0.927137E	0.1312636 -0.349586 -0.149586 -0.1951606 -0.3495626	- 9. 2447 07E - 9. 281779E - 16. 2243 62E - 6. 643 63 7E	0.3369106 9.7501866 -4.8752186 0.2243826	0. 916620E 0. 2465 63E 0. 2266 0GE 0. 7501 67E	- 6.241735 - 6.241735 - 9.2243825 - 6.334999	6.336910E 6.756837E 6.679213E 6.336963E 4.164586E	5. 9166 1% 6. 2244 07 6. 2244 06	- 0. 706517E 0. 26177E - 0. 393042E
		# 75 6 7 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8		2 2 2 2	###X	3 4 6 6	* * * * * * * * * * * * * * * * * * * *	##### ################################	F A N N	F 86
		111	7,77	1111			, , , ,	116		1 1
	PGACE	4 - 12 22	4 中が22	2 2 2 2	2224	2222	2222	記述記れる	2222	222
	2	•	~	•	•	۵)	~	m	•
		2	72	**	2	S.	7	*	33	*
						254				
		\$2 6	4810	4520	4810	6 kg	A 510	4 S E E	45	9 220
		•	a	٥	Õ	0	•	0	9	0

FIGURE III-D.15 CONTINUED

4810

orse

255

COMCENDED

III-D.15

PIGURE

The Control of the Co

Best of the contract of the co

1

*

7

(我的人 大 我, 五年,

GPRINT OF KATRIX LOADS - TRIANGULAR PRISM KLEMENT, CANTILEVER BEAM III D.16 F. GURB

*	•••	-0.17244730 E-05	-0.67784047 E-05	-0. 24936168E-94	••0	-6.26 7308 13E-05	-0-47 843 2 ye E-05	-0. IL 109276 F-04	•	-0.34855846-05	-0.626742736-05	-0. MS388361-04	3	-0.13994290E-65	-0.61994055E-05	-0.15940849E-04
•	0	-4.18232240E-05	-9. 354431896-05	- 0. 54 \$52 \$60E~05	000	0.10807307E-05	6. 22 61.291 UE-05	6.387945 C&E-08	Š	-4.16907572E-45	-C. 22 06 7 36 1 E-65	~ \$. 33 673 648 E~65	04	0.1\$002559E-65	0.33491225E-05	0. 62887530E-05
Ð	0.0	0.5196209%-06	Q. 2285644E- 05	0.541319646-05	\$	0. 6226638%- 06	0.20037362-05	0.99990546-05	0.5	6. 3634659 %- 06	9.212454fTE-05	0- 51006062- 03	0 ° 0	0. 999512926- ob	a. 2973 0494E- 65	9. 664491 90E- 05
20.	-	~	•	*	tn.	•	>	•	• 57	2	et 21	21	n	\$	23	2

DISPLACEMENT MATRIX - THIANGULAR PRISM ELEMENT, CANTILEVER BRAN FIGURE III-D.17

REACTION MATRIX - TRIANGULAR PRISH ELIGIENT, CANTILEPER BEAM FIGURE III-D.18

and the second

ELENENT 9 R 1 S M TRIANGULAR E E STRESSES

まって様

*

(STRESS POINT ONE ECLAIS ELEMENT STRESSES AT CENTROID OF TETRAHEDRON WITH NUDE SIG+2-3-12) (STRESS POINT THO ECLAIS ELEMENT STRESSES AT CENTROID OF TETRAHEDRON WITH NODESIG+2-1-41) (STRESS PCINT THREE EGLAIS ELEMENT STRESSES AT CENTROID OF TETRAHEDRON WITH NODESIG+6-5-418

		88		# W	
		536FA-2X 0.0 5.04737320E 6.326E7568E	81686-2X 0.0 0.0 0.0	516#2~2X 6. 0 6. 4973 7920 6 6. 32 (47968 6	
		35 5		868	
	2	SI GNA~ VI 0.22597044E 0.27124344E - 0.27554344E	SI GRA- Y2 0.0 0.0	SI 244- V. C. 22 39 7046 C. 27 1246 74E C. 27 25434 4E	
'n	•	55.55 57.55 57.55 57.55	3 8000 200	164 165 174 160 184 160 184 18	
ELENENT OR TO POINTS	*	004		1	
2 8	•	858		858	
KEN1	•	A- XY 38 8 1 6 20 6 4 6	* X	72.58 72.58	×
3) 83	r	MEMBRAME STAESSES SIGNA-XY SIE DI "0.61643681E BRE OI 0.129371706 BYE OI 0.76392064E	PENBLANE STRESSES STOKA-EY 0.0 0.0 0.0	#ERBGANE STRESSES -2 SEGRANY 11E OL -0.61643681E 63E OL 0.12557174E 69E OL 0.7695264E	gular pris
Y PE	~	2 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	8 X X X	GGANE O1 O1	TRIAN
ELEPENT TYPE	16	3698.704°0 31128.448 0.04918 0.04918	2-4401 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	\$ 1644-2 0.346432 11 E 01 0.39816183 E 01 -0.440735 69 E 01	STRESS UDTPUT, ELEMENT NO. 1 - TRIANGULAR PRISM ELEMENT, CANTILEVER BEAN
Bees		58 5		585	I, ECB
ELEPENT NUPES	~	3094766670 0. 204486 0. 203604 0. 203604 0. 203604	7-38-0 9-0 9-0 9-0 9-0	51944-Y 0, 65390468 6, 19543446 6, 78914660E	STRESS OUTPU ELEMENT, CAN
UPMB ER				5 5 5	61
ION N	640	AESSE 013 113 113 113 113 113 113 113 113 113	# * * * *	_	III-D.19
LGAD CONDITION NUMBER		APPAR BYT ELEMENT STRESSES STRESS SIGMA-X POINT 0.34443211E G1 2 0.43144600E G1 3 -0.51817427E 41	APPLIED STRESSES SECRA-X 0.0 0.0 0.0	NET ALEMENT STRESSES STRESS POINT STEAM-X 2 0-334648711E 2 0-43164670E 3 -0.51817627E	FIGURE
ĭ		APPAR BAT STRESS POINT 2	BLEVENT AL SYRESS POINT 1 2 3	NET A.EMB STRESS POINT 2 2	259

Committee and an analysis

-

ELEMENT ** 5 1 7 4 TRIANGULAR w 次 い 止 SES STRES

(STRESS POINT THE ECLAIS ELEMENT STRESSES AT CENTROID OF TETRAMEDROW WITH WOJES(4,2,3,1))
(STRESS POINT THREE ECLAIS ELEMENT STRESSES AT CENTROID OF TETWAMEDROW WITH NOOFS(4,2,1,4))
(STRESS POINT THREE ECLAIS ELEMENT STRESSES AT CENTROID OF TETRAMEDROW WITH MODES(2,6,5,4))

	71
	3
C IN TS	€ i
LEMENT GRID PGINTS	15 18
THE	15
EL E	-
ELEPENT TYPE	16
SLEPENT ALPBER	*
LOAD CONDITION NUMBER	mi

\$16#A-2x 0.17658346 00 -0.252810316-01 -0.75215818E 00	77-4458 0 0 0 0 0 0 0	\$16#4-2% 0.1159838E 00 -0.29281031E-01 -0.7971931%E 00
SIGNA-YZ 0.24272919E GI -C.12666357E GI -C.30666318E GI	S1 GMA- VZ 0.0 0.0 0.0 0.0	SIGNA-YZ C.242729196 CE -C.12466976 CE - 0.304605146 C1
MEMBRANE STRESSES 	MENTRANE STRESSES 516NA-KY 0.0 0.0 0.0	MEMBRANE STRESSES 24E OL -0.953128092 00 02E 01 -0.11413012E 01 02E 01 0.1194622EE 01
MEMPRANE S 1 GPA-2 0 - 36 50 10 24 E 01 0 - 245 477 02 E 01 9 - 1440 46 02 E 01	8 1 GMG-2 0.0 0.0 1 GMG-2	5 16 PA-7 0.3950 1024 E 01 0.2454 9702 E 01 0.24540 902 E 01
\$16PA~\\ 0.79760122E	\$1688-7 0.0 0.0	SIGPA-Y 0.79760122E 01 -0.6499439E 01 -0.1099422E C2
APPAR BNT ELEM BNT STRESSES STRESS POINT SIGNA-X 1 0.44074519E 01 2 -0.37657166E 00 3 0.15577698E CO	REMENT APPLIED STRESSES STRESS SIGNA-X NOINT 0.0 2 0.0 3 0.0	NET ELEMENT STRESSES STRESS POINT 0.49074519F 01 2 -0.374571466F CC 3 0.15577698E CC
APPAR BY: STRESS POINT 1	ELEMENT STRESS FOINT 2	NET ELEN STRESS POINT 1

260

FIGURE III-D.20 STRESS OUTPUT ELEMENT NO. 6 - TRIANGULAR PRISH ELEMENT, CANTILEVER BEAM E. C

	단 #				
	v				
ELEMENT GRID POINTS	8				
GK 10	5				
) 22	₩.				
EL EM	~				TRIANGULAR PRISK
ELEPENT TYPE	5	F2 0.50970963E G2 -0.50962725C 02 0.90368203E 01 -0.41170395E 02 6.325229E 02 -0.45930461E 00	7 <u>7</u>	6.90\$7@63E 02 -0.90\$@27.25E 02 -0.903@8203E 01 -0.325238.29E 02 -0.45\$30\$81E 00	1 ed
ELEPEAT ALPBEF	**	FCRCES FY 0,71572342E C2 -0,55049362E C2 -0,70745485E C2 0,44424530E C2	94449 9 0 0 0 0 0 0	FCACE 5 FY 0,71572342E 92 -0,55645342E 02 6,234411 01E 02 0,44424530E 02 0,44424530E 02	FORCE OUTPUT, ELEMENT NO ELEMENT, CANTILISVER BEAM
LOAD CONDITION NUMBER	es#	ELEMENT FORCES -0.15047638E G2 -0.11240540E G1 0.25724776E 01 -0.45959943E 01 -0.45959943E 01	4.PP. IED FORCES 0.0 0.0 0.0 0.0 0.0 0.0	MET ELEMENT FORCES POINT 1 -0.15047638E 02 2 -0.11240340E 01 3 0.21784470E 02 4 0.25726746E 01 5 -0.4595563E 01 0.2572676E 01	FIGURE III-D.21
		APPARELT POINT NO NO NO NO NO NO NO NO NO NO NO NO NO	POINT NOT NOT NOT NOT NOT NOT NOT NOT NOT N	#####################################	1

ELEREX F 2 2 4 6 TRIANGURAR ₩ ¥ FORCES

2			
.			
ELEMENT CRID POINTS 7 15 11 8			
2 3			
E 25.			
EL EM			
ic Element type	0.53542666 01 -0.40652106 02 0.776746906 02 -0.85377446 00 -0.817/42816-02	# • • • • • • • • • • • • • • •	6. 933426 61 -0.40653266 61 6.27476 98 62 -0.89327346 60 -0.8179628
ELEMENT PLYBER	FORCE: FV IT TT4 156 G2 -0, 541298 E38 G2 0, 43231 5838 G2 0, 46665 E58 G2 0, 66665 E58 G2	** ** ** ** ** ** ** ** ** ** ** ** **	FUNCES FY PA 13 F COCES -0. 171774 19E G2 0. 43 53 23 49E G2 0. 44 64 64 5 95E G2 -0. 44 64 64 5 95E G2
LOAD CONDITION NUMBER	APP AR ONT ELENENT FORCES POINT 1 -0.3641 5185E 02 2 0.35607129E 02 3 -0.3813201E 01 5 0.97656296E-03 6 0.19034139E-01	ELEKENT APPLIED FOACES POINT 1 6.0 2 0.0 3 0.0 4 0.0 5 0.0	#ET ELEMENT PORCES PORMT 1

PORCE OUTPUT, ELEMENT NO. 6 - TRIANGULAR PRISM ELEMENT, CANTILEVER BEAM III-D.22 FIGURE

E. Symmetric Triangular Prism

A six element cantilever beam subjected to an end moment is shown in Figure III-E.l. This figure depicts the loading, idealization, dimensions, and material properties. The preprinted input data forms for this example are given in Figures III-E.2 to III-E.9. Preparation of input data for this element is straight forward, however, a comment must be made on the ''Element Control Data'' form, Figure III-E.8. Since we are using a symmetric triangular prism element only three (3) node points define the element. Although column 34 in this figure indicates that 6 input nodes are needed the user only inputs the three pertinent node points. Note also that the ''Plug No,'' columns 11 and 12 is the same as used for the symmetric triangular prism element. It is also important to note that the user must define the global XY plane as the plane of symmetry for the symmetric triangular prism.

The output supplied by the MAGIC III System for this particular example is described below and shown in Figures III-E.10 to III-E.21. The matrix abstractions are shown in Figures III-E.10. A complete description of the instructions is provided in Reference 5. Output from the Structural Systems Monitor is given in Figures III-E.11 to III-E.13. These figures record the data pertinent to the problem being solved.

The problem title and material data output are shown in Figure III-E.11. Gridpoint coordinates, temperatures, and pressures are given in Figure III-E.12, as well as boundary condition information and element description. In the boundary condition portion of the figure, zeros ('0') represent degrees of freedom that are fixed (i.e. no motion) and ones ('1') represent degrees of freedom that are free or have unknown values of displacement. The second last column represents the cumulative number of degrees of freedom which actively participate in the equation solving process for displacements. The last column accumulates the number of twos ('2') which participate in the calculation of the reduced stiffness matrix. The third portion of Figure III-E.12

shows the finite element description. Each of the six elements is called out in turn with gridpoints, print options and material number. Note that no extra grid points are listed nor needed for this element. The same comment also holds for section properties since all pertinent data are calculated within the program.

Figure III-E13 displays the external load condition and transformed external assembled load column. This 24xl vector is the total unreduced load which is read row-wise. The ordering of this vector is consistent with that of the boundary condition table given in Figure III-E.12. Note that a load of 66.66667 pounds is applied at node 4 in the negative global Y direction. This is position (11,1) in the load vector which corresponds to the eleventh entry in the boundary condition table which is the global V displacement for node point 4. The other loads follow the same pattern.

MAGIC III system output of final results are displayed in Figures III-E.14 to III-E.21. Figure III-E.14 shows the stiffness matrix for this problem. Note that only the non-zero terms are displayed. The stiffness matrix is presented row-wise and it's ordering is consistent with that of the boundary condition table previously discussed. In this problem the ordering is

$$\{\Delta^{SP}\}^{T} = [u_2, v_2, w_2, u_3, v_3, w_3, \dots u_8, v_8, w_8]$$

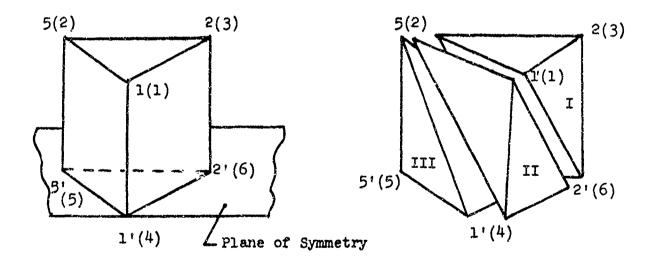
with displacements U_1, V_1, W_1 and U_5, V_5 and W_5 fixed.

The externally applied load vector (GFRINT OF MATRIX LOADS) is presented in Figure III-E.15. This figure shows that forces (F_Y) are applied in the negative and positive global Y directions at nodes 4 and 8. These forces are numerically equal to ± 66.66667 pounds and are directed to form a moment of $M_X = 800$ in pounds applied at the tip of the cantilever.

The displacements of the cantilever beam resulting from the above loads are given in Figure III-E.16. These displacements (U, V, W) are output corresponding to node point number and are referenced to the global axes unless otherwise noted. Figure III-E.17 shows the reactions (F_X, F_y, F_z) . These are also output corres-

ponding to node point number and are referenced to the global axes system unless otherwise specified.

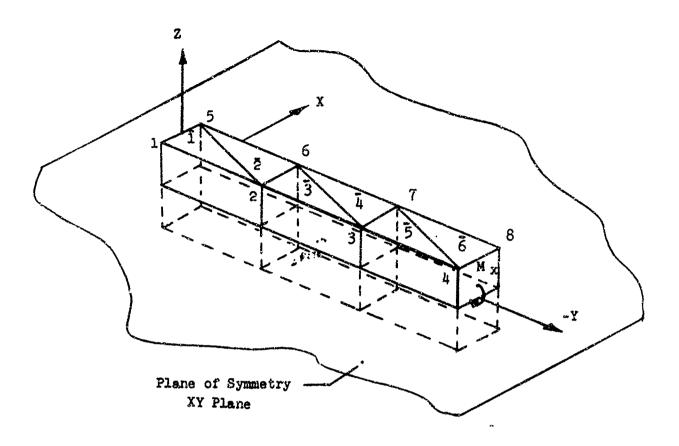
The stresses arising in the structure are displayed in tabular form in Figures III-E.18 and III-E.19 for elements 1 and 6 for example. Stresses are defined at the centroid and are referenced to the global axes for each tetrahedron which makes up a particular symmetric triangular prism element. Three stress points are given under each stress category for each prism. These stress points correspond to the stresses in particular tetrahedrons which are defined in the heading of the stress data. The tetrahedron nodes listed are the local node numbering system and these must be correlated with the gridpoint numbering system. In the present case, element number one is defined as shown in the sketch below:



The numbers in parenthesis correspond to the local element numbering system (See Reference 7) and the other numbers are global gridpoints. The Roman numerals on the right hand sketch are the tetrahedron numbering system. The remaining elements in the idealization are handled in the same fashior

The last set of output is given in Figures III-E.20 and III-E.21 and consist of the global oriented element forces.

Output labeling is analogous to the stress output except that the element forces are defined only at the three corner points of the symmetric triangular prism element. Three force points are given and for element number one for example, force points 1, 2, 3 correspond to element gridpoint numbers 5, 2, and 6 respectively.



$$E_{x} = E_{y} = E_{z} = E = 30.0 \times 10^{6} \text{ psi}$$

$$V_{xy} = V_{yx} = V_{yz} = V_{zy} = V_{zx} = V_{xz} = V = .333$$

$$E_{x} = E_{x} = E_{z} = 0, \quad T_{1} = T_{2} = \cdots T_{16} = 0.0$$

$$M_{xz} = 800 \text{ in}$$

Figure III.E.1 Symmetrical Triangular Prism - Cantilevered Beam With End Moment

STANTER SAMALLY SES KANKING FRANTAD LAMAS MANTER THAT THE - SYMMETRIC TRIANGULAR PRISM, THIS IS THE FINST ENTRY ON ALL REPORT FORM INPUT RUNE AND IT IS REQUIRED FOR ALL RUNS. 1234567669123466788612348676967886788678867886788678867886 SYPHETRIZE TREMANAMEN PRESIDENTEN. 144. 511 TITLE INFORMATION CANTILEVER BEAM NUMBER OF TITLE CARDS III-E.2 3 1 2 3 6 8 8 TITITE (/) FIGURE 268

BAC 1816

REFIGRE (/)

TITLE INFORMATION

MAGIC STRUCTURAL ANALYSIS SYSTEM INPUT DATA FORMAT

MATERIAL TAPE INPUT

	3															
ALVER DESIGNATIVE	2 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3			*	ŝ	5	=	<u> </u>	Ē	<u> </u>	Ē	Ξ	Ē	Ξ	Š H	
	0 0 0 0 0 0		ATY ASSOUR	7 6 8 6												
he sudmovit	+ Q	4	RIGIDITY	0 0												
And the state of t	3.5	7	*36:	1000	Ţ	<u>ن</u> چ	-			<u> </u>		<u></u>				1
J'Yold Wrift olds?	8	1		~		Ë	Ľ						-2-			
east mint	7	1	K OF ANDOR	***	W						E					
soote@ ishesoki	**]	A Section	9							E					
Craverents Vote Physics	8	-	3	*	•				-							
aidening aideningi cheart	3	4		***0	Y		F									
Ormasapie	8	1	,	2	Å	Ė	Ė									
(spende)	2 ×		KATIUS	4.0												
	7.55 68 68 14		POKEBOPES	3 4 6 6 7 8	583											
CATION	2 9 G]	W2983		2	2	2			<u> </u>						
ERIAL IDENTIFICATION	70	4	DOCOM SI	6												
MATERIA	6 8	7	YOURGE	600	30.0											
	7 8 9 2 3	Π		18 2 1 2 5	9	2	23									
MAKEER MAKEER MOS Code	1 2 3 4 8 0 1 3 4 8 0	MATERIAL PROPERTIES TABLE	TEAPERATURE	34667												
Mequitit Volumbil	3	MATE				26	ia.									

MATERIAL TAPE INPUT - SYMMETRIC TRIANGULAR PRISM, -III-E.3 FIGURE

MANAGE OF THE PROPERTY OF THE PARTY OF THE P

SYSTEM CONTROL INFORMATION

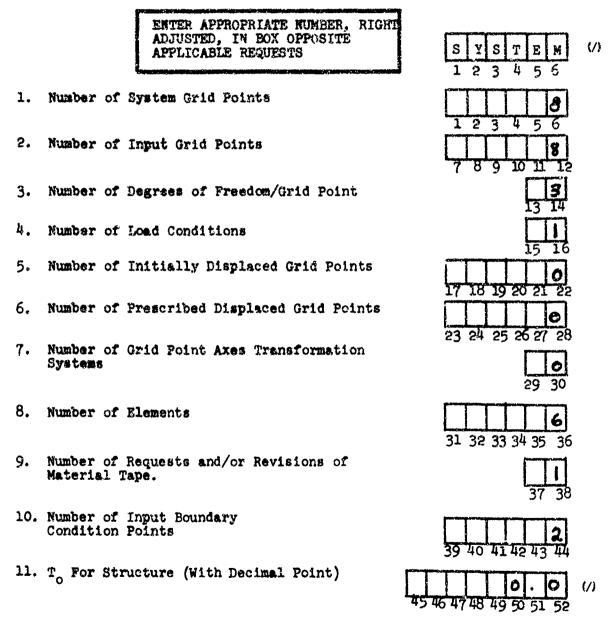


FIGURE III- E4 SYSTEM CONTROL INFORMATION - SYMMETRIC TRIANGULAR PRISM, CANTILEVER BEAM

1 23458

GRIDPOINT COORDINATE

														D			R			C	1	Γ	1	С)	N	•	S								
(eri Na	d l)	×		R							Y	_	• ﴿	3							Z	_	. ;	2	~			
7 5	3 1	9	0	1	2	13	4			. 7	7 1	1) (1	2	3	4	5	6	7	8	9	30	1	3	3	4	5	E	7	8	9	40	1	2	
Ţ					1	_	2	Ŀ	.0		L	L	L		L	0		0								3	•	q								1 1
1	l	1			2	L	5	Į.	0	1	L	L	1		L	Ŀ	h		0							2	٠	9								()
		1			3	<u> -</u>	1	l.	Ø	1	L	L	L	L	L	ŀ	1	Н		0						5	•	q								1
	l	1			4	Ŀ	2	Ŀ	0	1	L	L			L	Ŀ	2	١		8						8		Ş								1.
					5	2	ŀ	c			L					0	۰	9								3	•	0								(,
I		J			6	3	Į.	e		I		\prod	I			E		[.	6								•	-	_]						1
ĺ		Ţ		_		9			_	I						F	1	4		•						10	•	0		Ţ						t.
	I	\int			8	3	ŀ	0		I	I					E	3	9	,	0						19.			\int							ŧ.
I	Ι	\int						I		Γ	I		Γ																							(
		ĺ				Ĺ																							J							1
									ĺ		I		Ī		Γ		Γ																			,
Ţ	T	T				Γ	Γ	Γ	Γ	Γ	Γ	Γ	Γ	Γ	Γ		Γ																			í
T	T	T				Γ	Γ	Γ	T	Ī	T	T	T	Γ				Г								П				1		_				(
T	T	T				Γ	Γ	Γ	Γ	T	T	Τ	T	T			Γ	Γ	П											1						(
T	T	T					Γ	Ī	Ī	Ī	T		T	Γ	Γ	Γ	Γ											٦	1	٦		_	П			1
T	7	7				Γ	Γ	Γ	T	T	Ī	Ī	T	Γ			Γ						П						1	٦		-	П			1
T	T	7					Γ	T	T	T	T	T	T	T	Γ	Γ				Ī								٦	1	1	`	_	٦		_	1
T	T	1				Γ		T	T	T	T	T	T	T	Γ											Н			7	7	7		П	٦		(
T	†	1	٦			Γ	Г	T	T	T	r	T	T	T		r													1	1	1		٦	7		(
T	T	T				Γ	Γ	Γ	T	T	T	T	T	T	Г			_	П					7				1	7	7	1		П	٦		(
T	T	1				Ì	T	T	1	T	t	T	T	T	Γ	r		П			٦							1	7	7	7			7	7	(
T	T	1	7			Г	Γ	1	T	T	T	T	T	T	Γ	r	Г	П										7	7	7	7	-		7	ᅦ	(
T	1	1	7			T		T	T	T	T	T	T	Γ		Г				٦	7			7				7	7	1	7			7		€.
T	T	1			П	Γ	Γ	T	T	T	T	T	T	T		r			П		7		٦	7	٦			7	7	7	7			7	_	€.
T	T	†	7					T	t	t	T	T	t	T		r			٦	7	7	٦		7	7	H	+	7	7	7	7	7	+	+	7	
t	t	†	1	1			一	T	T	t	1	T	t	T	Н	H		Н	٦	H	7	7	7	7	7	H	+	+	†	†	+	+	1	+	┥	(
t	t	†	1	٦		T	1	T	T	t	T	1	t	+				Н	Н		7	H	1	7	٦	-	1	7	†	7	+	4	Н	+	٦	(
t	t	†	1	٦	Н	-	٢	t	t	t	t	t	t	t		<u> </u>		Н	Н		1		H	7	۲	H	4	+	+	+	+	-	+	+	-	(
t	t	t	1	٦	Н	۲	Ι-	t	t	t	t	t	t	†	Н	┝	-	Н	-	H	7	٦		ᅦ	٦	H	1	+	+	+	+	4	Н	+	┪	()

FIGURE III-E.5 GRIDPOINT COORDINATES - SYMMETRIC TRIANGULAR PRISM, CANTILEVER BEAM 271

BOUNDARY CONDITIONS

INPUT CODE - 0 - No Displacement Allowed 1 - Unknown Displacement 2 - Known Displacement

PRE-SET MODE

\$	2	3	4	5	6
848	O	O	A	L	

TRA	NSLAT	IONS	RO	TATIC	NS	GEI	VERAL	IZED
บ	٧	W	Θz	Вy	Θz	1	2	3
13	14	15	18	17	18	19	20	21
1	1	1						

LISTED INPUT

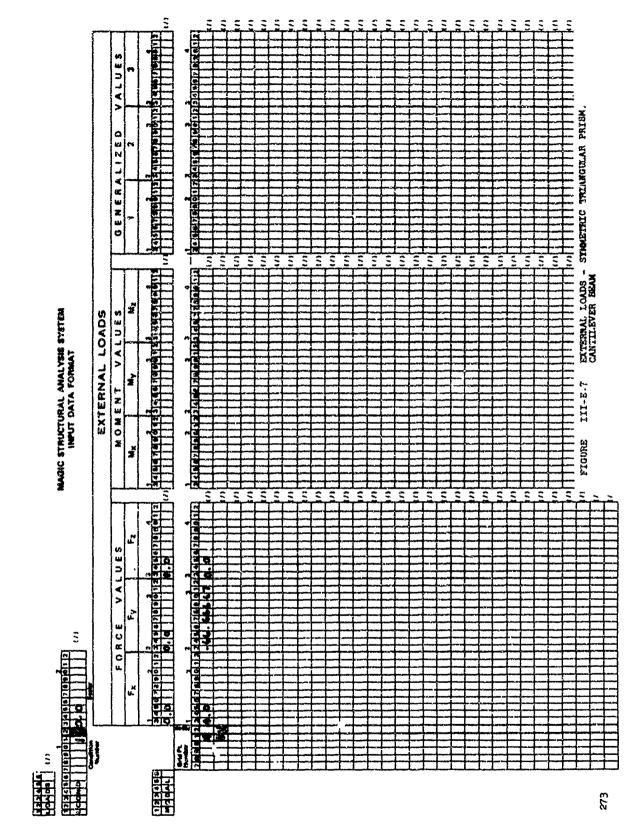
G	ri	e P	el	nt T	2									
7		9	9	1	3	13	14	16	16	17	18	19	78	21
_				•		0	0	0						
	L			5	K									
_	L			L	Ц									
_	L	L	L	L										
_	L			L	Ц									
	L	L	L	L	Ц									
•	L	L	L	Ļ	Ц				<u> </u>					
_	L	L	L	L	Ц		ļ			 				
_	L	L	L	L	Ц		ļ			<u> </u>				
_	╀	L	_	L	Ц				ļ					
_	╀	Ļ	-	L	H			ļ	 	ļ	<u> </u>			
_	 -	L	┡	L	Ц			 	 	ļ				
_	Ļ	Ļ	L	L	Ц		<u> </u>		<u> </u>		 			
_	1	Ļ	Ļ	-	Į.		<u> </u>		 				<u> </u>	
_	ļ	1	Ļ	Ļ	\sqcup		ļ	<u> </u>	<u> </u>	<u> </u>		<u> </u>	ļ	
_	+	1	1	-	H			<u> </u>	}			<u> </u>	 	
_	ļ	1	1	1	L			<u> </u>	<u> </u>			<u> </u>		
_	+	1	1	-	L			ļ	<u> </u>		 -			
-	\downarrow	╀	L	ļ	H						 			
_	1	1	 -	Ļ	L						ļ			
							1	1			1	l		

FIGURE

III-E.6

BOUNDARY CONDITIONS - SYMMETRIC TRIANGULAR PRISM, CANTILEVER BEAM

272



BAC NEET

	S	
Г		3
		ì
С		7
Е	80 7	9
C		ė
Γ.	14	-

MAGIC STRUCTURAL ANALYSIS SYSTEM INPUT DATA FORMAT

RICKERT CONTROL DATA

			7	۵	১	\$	<u> ک</u>	<u>S</u>	ک	2	১	٤	۵	<u>5</u>	\$	১	<u>S</u>	<u>১</u>	১	<u>ড</u>	S	<u>S</u>	
	-												-	-									
	**	9			H						-												
		8																					
1	~	5																					
		*									-					_				-			
	0	-			-	-				-								_	-			-	
•	-	-6																					
		7																					
	•																			<u> </u>	-	 	
		20			-					-					-	-		-		-	-		
j- :		8								-	-			-									1
2		7																					
- 1		6																					
0	-	9				-				├ ┈	-			ļ					├		 		ĺ
•		-			-		-					-	-	-				-		 			!
	•	2							-														
		-								-					-					├	<u> </u>	}	Į
١		9									-		-	-		-			 	┼	١		İ
9	•	-				-	-				-				-			 -	-	 	┼	 	İ
ō	-	-				-				 		-				-	-			-			Ĺ
Z	•	39																					ĺ
		9		_				344		ļ			┝		_				<u> </u>		├	-	l
ĺ		3.	-0	32	•9		-	30		ļ	 -				-			├	 	 	 -	 	Į
1		2			-		-	_			├	-	-	- -	-			 	 	 	_	†	į
1		3	Ç	5	77)	66	E	Æ															l
	~	76												-						1	}	 	Ì
1		8 9	_	10	a		7.7	~	-	-		 -	 	-		-	-	-	 			 -	Ì
l	_	1	=	-	-	-34	-		-	-		-		1									l
<u> </u>		က္စ																					ļ
72.0	A No. OH	×S			I								1	1				1		1		į	ĺ
	alt teach			-		-3	-	- 3			-	-	┼	 			-	├	-			 	į
14	Hamber	mm	-32		38		-				1		<u> </u>								上		İ
	1104																					T	ļ
_	33%	-	-	-						├	-		-	╁	├	-	-	ļ	 	 	-	+	ł
1 2	E168.	5							ł	Į	•	1	Į	i .			l		1	1	l	L	
PRINT	Ining	_							1										ì	1	Τ	T	Ī
L	<u> </u>							<u></u>		L	<u>Ļ</u> .	Ļ.,		 		_		_		↓	ļ.,	4-	ļ
14	gal mel3	8		Į	l			ĺ	1	l	l		1	1	1	1	l		l		l	1	
	estri all	- -	 	-	 		-	-		 	┼~~	 -	 	┼	 	 	 	 	 	┼~	+	+	t
.69	3 10 3 46 %	8	l		l			1	ł	Į	ĺ	ļ		l	1	i	l		1			ĺ	l
1		•	<u> </u>		 		}	 			 	-	 	}			 	}	}	┼	┼	╅	ł
j		-	} -	├		<u></u>	 			-	┼	┼	┼	}	 	-	├	┼~	╅	╁	╁	┪	t
] :	ž ž	2	 	 	 	1-	 	-	 	1-	†	_	1										İ
1	2 3	•																		Γ.	1	_	Į
		2 [3							-			Ļ	 	↓	↓	ļ	<u> </u>	┼	┦	╄-	ـ	┿┈	ļ
			├	├	├ ─-	├	├		├		╅	┼	 	 	┼─	-	├	╫┈	+	╁╾	╁	+-	ŧ
L		88	<u> </u>				上												<u>† </u>				t
	Collection of the collection o	2	m	100	180	M	~	20		Π			Γ	T		Γ		Τ	Т	Т	T	T	T
1	al any other	 _	<u> </u>	=		-		-	├	-	┼	┼	┼	┼	┼	├-	├	-	 	╅	┼	┿┈	ŧ
		~	 -	一	一	一	+=	=	 	 	+	t^{-}	ا ا	1	 			1	\perp	İ	1	1	ţ
	RUMBER)						I		ľ
		3		Ţ							L			1	↓ _		_	-		-	ļ_	4	ļ
	MATERIAL	*		 	<u> </u>	-		_	<u> </u>	 	 	├	┼	+-	┼	 -	-	┼-	╂	┼	┽	+-	Ŧ
	N SOTA	2 3		-	-		 		-	┼	+	┿	 -	┽—	┼		-	-	+	┿╾	+	+-	t
1 0	₩ 20.1 4	1	S	In	35	7	ম	20	 	†	+	 	+	+	 -	 	† -	1	<u> </u>	İ	1	士	†
		-0		त	3	Œ	10			I			I	1	二			-	T	T	u	Ţ	Į
1	MAKEE	-	L	ļ	+		- -	 	-	┼	┼	┼	┼		+	-	┼	+-	+-	+-	╁	+	t
1 1	a demograph		1	1	1		1	<u> </u>	J	1	<u> </u>	ــــــــــــــــــــــــــــــــــــــ		ل	J	1	-	1					4

ELEMENT CONTROL DATA - SYMMETRIC TRIANGULAR PRISM, CANTILEVER BEAM III-E.8 FIGURE

CHECK OR END CARD

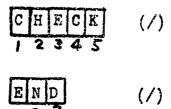


FIGURE III-E.9 END CARD - SYMMETRIC TRIANGULAR PRISM, CANTILEVER BEAM

TEST MAGIC

STAST RUCTION SOURCE

TESTCODA

7ESTC005 7ESYC006 * • TESYCO07	TESTC000 TESTC000	TESTCOLO	•	TESTCOLS	TESTCOLA	1ESTC016	16510017	7ESTC010	TESTC020	TESTC021 TFSTC022	TESTC 023	TESTC024	TESTC024	TESTC027	TESTC028	16515027	TESTCOSI	7857C032	TESTCOBA	TESTCOSS	165 fC 034	TESTC036	TESTC 036	16517040	TESTCO62	TESTCO+3	TESTC 044	TESTCOOL	16570067	1651000	TESTCOSO	TESTC 951	TESTC053 TESTC054
STATICS AGENDUM bitholt Prescrieec cisplacepents	STATICS INSTRUCTION SECLENCE			GENERATE ELEPENT MAINICES	SM. 30. MLD. TR MEL. FTEL SEL . STEL SC. EM		10 4 10 4 10 644 Take 10	1 FC6			<u>.</u>	ACCOURTS CTREAMENT WATER AND SUBMEAT AREA TEN LOADS			MICHIEL BERN GENORER GNOCHOUS	3	REDUCE STIFFMESS MATRIE AND FRINT	KONKNO - KELA DEJOIN. (SE(S.1).1)	KCO, STIPF - KING, DEJOIN, (SC (5.17.0)	PAINTIFOACE, DISP STIFF	FORM REDUCED TOTAL LCAE CCLUPA		MULTIPLY ELEMENT APPLIED (CACS EV LCAD SCALAR	これでは、 フェンプス・プログラン こうしゅうじゅう こうしゅうしゅう しゅうけんしょう かんかい かいかい かいしゅう しゅうしゅう しゅうしゅう かいかい かいかい かいかい かいかい かいかい かいかい かいかい かい	7-1-6 11 6/8/11	ATOTAL	THE STATE OF THE STANDARD STAN		SOLVE FOR DISPLACEMENTS	XX . STIFF. # OF L. TLOADR	9	K = W12. ML 1.9 V	CALCULATE REACTIONS AND INVERSE CHECK
កូតក		U	ں ں	, u		276 v m		o u	· u	m·	• r		. U	•	• ;	91 91	, 0	u (2.5	ں :	A 04		بر	15	2	2=	JŲ

PIGURE III-E.10 MAGIC ABSTRACT INSTRUCTION LISTING - SYMMETRIC TRIANGULAR TRISM, CANTILEVER BEAM

TEST MAGIC

16510055 16510055 16510054 16510054	TESTC059 TESTC060 TESTC063	TESTC062 TESTC063	75570064 75570069 75570066	7657C067 7857C060 7687C060	TESTG#10 TESTG#11	TESTCOT2 TESTCOT3 TESTCOT4	1657C075 1657C076 1657C076	16370974 7637093 7637093 7637098
	PRINT ELEMENT APPLIED ICACS, ENTERNAL ICADS, DISPLACIMENTS, REACTIONS AND INVERSE CHECK IN EAGINEERING FORMAT		TR SFTELA) BICACS	であるはながらしかは、いち マカルのによる	EECCH	OFFUSE STREET	O-TE-SC.TS DREACTS	
REACTS - KELA.HLII.XO Reactp- Reacts.Sibt.Tecad Sf toiff.Mull.) GO to 10	PRINT ELEMENT APPLIED ICACS, EXTERNAL LCADS, REACTIONS AND INVERSE CHECK IN EAGINEERING	ELEMENTS HAVE 1 OF 2 DEGREFS OF FREEDOM	GPR 188 TG 4.0.F N.F V.F d. BY. BY. D. S.C. TB FFTELA GPR 58 TG 4.0.F N.F V.F.Z. BX. BY. PV. P.Z. SC.	Con in to december the way in the war had a vertage second of the interpretage of the second of the second of the interpretage of the second o	CLEARNYS HAVE 3 DEGREES OF SPEEDEN	CPR TRITE A FR. O. F.Z. O. FRE BA. G. FILO. F3.5C. FR 3FFELA CPR ENTE 4 FR. O. F.Z. O. FRE TA. C. FL.O. F3.5C. ILCAN SPR TRITE 20 . 11. O. L. D. TRIE TA. C. P. D. L. A. C. F.	GENERAL STREETS AND PERCE	
) ပ ပ ပ	ں بي د	,	4	ن ن ر	9	UU	3 277
320			7 M	7 W &		222	2	ಷ ಕ್ಷು ೯) M

MAGIC AESTRACT INSTRUCTION LISTING - SYMMETRIC TRIANGULAR PRISM, CANTILEVER BEAM (CONCLUDED) PIOURE III-2.10

STATICS ARELYSTS CONCENTRATED LUADS ENGERALENT TO MOMENT. SIX ELEPTRICATION PER PER SUBJECTED TO AN END MONENT Sveng tase lasabbellas saise suga. Mi.St

PRVISICH BF PER BASAL TAFE

ASTERISK IN) PRECENTING MATCHIA. INCOTERCATION INDICATOR SYAT WENT EPACE PETURNE HILL NOT RESALT IN TERRIBATION OF ENGULTION

7.8 3000 0.0 0.0 300 0.0 V. 0-1125206 CG DINK TRUMS DIA SC TIONS 8 ** 11.25.28E 00 9. 33 MOSOF POSSECH'S RATEDS A I GIBITY MODELE INCUT CORE 6. 3898886.6 CATERIAL INDUSTRIBLESTEEL
SCHOOLSE INDUSTRIBLESTEEL
SCHOOLSE OF AN TEREST POCHETY PCERTS.... 1
ANTHER OF PLASTIC PROPERTY POINTS.... 0
RASS EGRITY.... 0. T. 0. 0. T. 0. 0. T. ** 308686K 49 11 6. 65 60 60 6. 68 DI PECTICAS DI MECTICAS MINES FORTH M. EW.COFF. P. MENGER CS 59-2503059*6 HATTHER, PROPERTIES ARVIS BER P GROCALTURE TENPERATURE j r L 278

8

209686 S

An 112520E 88

FIGURE III-E.11 TITLE AND MATERIAL DATA COTFOT - SYMMETRIC TRIAMOULAR PRISE,

Add to the section of

PIGUNE III-E.12 GRIDPOINT DATH, BOUNDANY CONDITION AND PINITA REMANY DESCRION COTPUT - SYNDHENIA REPROPERTABLE TRIANGULAR PRISM, CARTILLEVER MAN

a committee of the second of t

	•
	ELEPENT LCAD SCALAR &
	Ů,
	FLEPENT
•	-6.0 MODES 6 -6.6667E 62 0.0 -6.6667E 62 0.0 -6.6667E 62 0.0 -6.6667E 62 0.0 -6.6667E 62 0.0 -6.6667E 62 0.0 -6.6667E 62 0.0 -6.6667E 62 0.0 -6.6667E 62 0.0 -6.6667E 62 0.0
¥	# ·
LOAD NO.	* • • • • • • • • • • • • • • • • • • •

TPARFECAPED EXTERNAL ASSENDIED LOAD COLUMN

9 9.0 •• 9.

	0	0.0	o °	9
	©	-0.66te5c2E C2	93	-C. 6866E852E G2
24 x 1	9	0.0	0*0	0.0
*	0.0	o 6	0•0	0.0
	ນ•0	.		

T-ZEAC FCF STRUCTURE . 0.0

280

an en semante and semante commence of the semante and semante

FCPCE 0.183351E C9 2 -0.164455E 08 3 -0.262546E 08 -0.184514E C9 11 0.16455E 08 12 0.262546E 08 -0.184514E C9 12 0.262546E 08 -0.184514E C9 12 0.262546E 08 -0.262546E 08 -0.262546E 08 -0.262546E C9 11 0.194524E C9 12 0.262546E 08 -0.262546E C9 11 0.194524E C9 12 0.262546E C9 11 0.194524E C9 12 0.262546E C9 11 0.194524E C9 12 0.262546E C9 11 0.194524E C9 12 0.262546E C9 11 0.194524E C9 12 0.262640E C9 3 0.182111E C9 0.262546E C9 11 0.194524E C9 12 0.262640E C9 3 0.182111E C9 0.262640E C9 3 0.182111E C9 0.262640E C9 3 0.182111E C9 0.262640E C9 3 0.182111E C9 0.262640E C9 3 0.182111E C9 0.262640E C9 3 0.182111E C9 0.262640E C9 7 0	FORCE C.116351E C9 2	SIZE 1º BY 16	FORCE FORCE	4 -6.64301£ 07 5 0.112191E 08	4 0.562640E 07 " -0.256921E 03	4 -0.1312835 At 5 0.750137E GT 12 -0.59377E GE	4 0.183351E 0: 5 -0.168455E 08 30 -0.39325E C: 11 -0.158455E 09 15 0.282569E 0:	4 -0.168459E 0E : 0.13341EE 09 9 -0.750186E C7 10 -0.168455E 08 E4 -0.196924E 0E 15 -0.750137E 07	5 -0.180000E 02 e C.783477E 04 80 -0.531283E 0E 11 -0.750187E 07 85 -0.59077E 0E	7 G.12GG91E GS 8 G.627546E G1 15 G.131283E GE 16 -0.393258E 08	7 0.427546 0: 6 0.6030335 00 is 0.7501875 07 is 0.5626418 07	8 -0.750189E 07 4 6.351439E 08	4 -0.39125E CE 5 -0.160455E GE 12 0.26256E OE 13 -0.321506E C7	4 ~0.168455E 08 5 -0.434622E 07 12 6.309000E 01 13 0.112151E 09	4 0.23128% 06 5 0.750187E 07 12 0.783670E 3E 13 0.1094102 02
FOACE 0-103391E C9 2 -C.160465E 08 3 0-103391E C9 2 -C.160465E 08 3 0-0.786316E C8 11 0.16645F 09 12 0-0.786316E C8 11 0.16645F 09 11 0-0.7861EF 07 10 C.16645F 09 11 0-0.7861EF 07 10 C.16645F 09 11 0-0.7861EF 07 10 C.16645F 09 11 0-0.48626E C8 2 -C.260C0C 02 3 0-0.48626E C8 7 -C.26626E 09 11 0-0.48626E C8 7 -C.26626E 09 11 0-0.48626E C8 7 -C.26626E 09 11 0-0.48626E C8 7 -C.26626E 09 11 0-0.48626E C8 7 -C.266304E 07 9 0-0.48626E C8 7 -C.266304E 07 9 0-0.48626E C8 7 -C.26626E 09 11 0-0.48626E C8 7 -C.26626E 09 11 0-0.48626E C8 7 -C.26626E 07 9 0-0.48626E C8 7 -C.26626E 07 9 0-0.48626E C8 7 -C.26626E 07 9 0-0.48626E C8 8 -C.26626E 07 9 0-0.48626E C8 8 -C.26626E 07 9 0-0.48626E C8 8 -C.760167E 07 15 0-0.48626E C8 8 -C.760167E 07 15 0-0.48626E C8 8 -C.760167E 07 15 0-0.48626E C8 8 -C.760167E 07 15 0-0.48626E C8 8 -C.760167E 07 15 0-0.48626E C8 8 -C.760167E 07 15 0-0.48626E C8 8 -C.760167E 07 15 0-0.48626E C8 8 -C.760167E 07 15 0-0.48626E C8 8 -C.760167E 07 15 0-0.4866E C8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8	FOACE FO		ŭ,										-		
CUTOFF = 0.0 1	FOACE 1		FCFCE	00 32	90	00 00 00 00 00 00 00 00 00 00 00 00 00	200	00 07 07 03	404	• 4	* \$	7 70	~ A	900	07 09 11 10
CUTOFF = FCPC 1	FOACE 1	0	ш	-0.1684551	C.1334141 Q.1684551	-C.260C601	0.5626401-0-0-7865161	-C.256821 0.562640 C.750107	-c. 944 5241 c. 750189 -C. 242565	C.562640 -0.393258 C.131263		-6. 764 524 -C. 750187			
CUTCO 1	CUTCE 1		FCFC	7 1	2 02	201		# ~ 7							a4 ≠4
	700CE 1	1055													
		ů		0,183351	- 0.169659	- 6,242566 - 0,544524	- 0, 643016 - 9, 262566 0, 131283	0. 1121 11 - 0. 180000 - 0. 904622	- 0, 7501 E7 - 0, 134 2 E3 - 0, 1142 53	- 0. 632014 - 0. 631283 0. 112151	0.112155 - 0.790187 - 0.904621	- 6, 750% e4 - 0, 130, 23 - 6, 2953 26	- 6. 786516 - 0. 134243 0. 962635	6. 1684 53 . 0. 7501 67 - 0. 1284 12	0.262 546 - 0.1142 53 8,7501 87
			ORCE	~ 0	~ 4	~ •	2	- • :	242	* • 😭	405	~ II		- • •	
	281		H.	-	~	•	•	•	•	-	•	•	2	=	2

PIGURE III-E.14 STIFFNESS MATRIX OUTPUT - SYMMETRIC TRIANGUIAR PRISM, CANTILEVER BEAM

		8 8	3 5 8 8	5 8 8	3	8	Š
		0-174921£ 09	-0.584622E 07 -0.168455E 08	0. 7501 87F 07 0.262968F 00	0- 112191E OD	-0-1284116 06	-0, 1501 ABE 07
	FORCE	22	9 2 2	2 2 2	#	*	2
		2 5	000	965	50	55	9 0
16 B∀		0.1094 EQ.	-0-16045 tc	0-13128%	-0.321507E	0.56263 E	0-1312836 06
\$ 112 F	FOR CE	77	F 225	F 77	2 2	£ 2	M 40
		0.112191E 06 -6.321507E 07	6.750167E 07-0.129411E 06	-0.540772E 08 -0.759188E 07 0.105418E 02	-0.1312838 08 -0.168459E 08	0.5689615-61	-0.2953366 P
	FCBCE	= =	e 23	° 22	• =	• 5	• =
		0 0 0	# 5 % 6 6 6	588	6 6	* °	53
. 0.0		-0.322596E 07 C.262566E 09	-6.1%\$24E @B C.562639E 07 (.266600E 02	-C.750187E 07 0-131283E 66 C.783578E 08	0.542641E 87 C.660452E 88	-C.984621E 07 -G.168455E 06	-0.750187E 67 0.131283E 04
CUTOFF . 0.0	FCNCE	16	# O #	e 0 3	• •		* *
8		3 5	358	282	28	35	26
Š		-0.138225E 08 -0.160459E 08	0.168499E - 0.750187E 0.107734E	0.242549E - 0.170347E 0.280000E	- 0.343258E 0.104416E	0. 1121 51E 0. 7501 £TE	0.1312836 - 0.9645296
	FORCE	• 4	* • *	404	F 2	13	۲ <u>۲</u>
	Ŀ	ន	±	t €^ emi	9	11	2
		4510	e 830	9810	9250	• S10	9510

FIGURE III-E.14 STIFFNESS MATRIX OUTFUT - SYNMETRIC TRIANGULAR FRISH, CANTILEYER BEAM (CONCLUDED)

CPATEST CF PASSIX LOACS 15-E7 11

•			: 3			: 3	3	0.00
:	ž	•3	;	-C. 46444 1125 ex	;	° 3	7	-4.6646672F R
×	0.0		:	;	ş	•	j	
ğ		*	•	•	•	•	~	•

PIGNUM III-E.15 GRUINY OF MATRIX LAKES - BYDMATRIC THIMSGULAR PRIME, CANTILBOUR MAM

ersolacepent matrix yan road combitium

~ × £

*	-0-20 MEMORING	-6-10-3E93378-69	- A. M. Witch 19 and .	-5-310E11026-69	4-407961100-05	-21.000-99.0-04
	** ***********************************				•	
• ;	6. 1845 4 84G- 84		***	-4. F349661E- 64	-0-120 00 10 -0-	
2	~ •	• •	26	4 (- 4	,

Piddes III-e.16 displacher metax - streeteur falmetear felder, chetilister beh

MENTITIES ARE EMPERSE CHECK ACK LONG CONDITION 2

. 2	4-TOBBES 734: 61	6.5F 1023-00 E-03	0.12# Wate-6s	0.21972696E-62	-6.78 ISAE70F 61	4.23.25.E.	-9. W404492E-93	-6.17049844 6-02
č	G-tecefvels on	C. Liberacie as	4. 14C21724C-22	C. 154412146-63	C.73354774E C2	C. 52.552 734 E-43	4.7£71.63¢96-83	4.274696208-69
2	- f. ivitation as	-4. I GH 090 H- C:	-6-936364339-80	-0-12367439E-C2	9-36284143E C2	-4-15251744-C3	- fr 1765 62 5 64- fi)	- 6. 73552186E- C3
3		*	•	•	•	•	•	•

PIGGRE 111-8.17 SPATION MATRIX - SPROGIESC TRIANGULAR PRISM, "ANTILEVER DIME

		51 GPA-2X 0.0 0.0 0.61 72 82 06 € 00	20 C C C C C C C C C C C C C C C C C C C	Sigra-2x 0.0 9.0 0.4 7212 Gr E OD
		300	တိုင် တိုင်	360 360
CENTROID OF TETRANEDRON WITH NOUESIE-1-4-1) CENTROID OF TETRANEDRON WITH NOUESIE-1-4-1) GLENERT GRID POINTS				
5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5		555		##
38 38	O		*	7004 7470 7470
2		SI CMA- 47 C. 35 F9 1075F C. 35 F4 1075F G. 55 F5 F4 T675F	24-42 25 26-00	SIGMA- V2 C. 358910798 C. 358910798 C. 255364768
2 2	_	SI GMA-Y? C. 351910795 C. 351910795 .0. 2519164705	443 2000	. กูลูลูลู พ.ม.ผ.
26 g	0	•		ŧ
AME 10	¥	88		88
D OF TETRAMEDRON WI 10 CF TETRAMEDRON W 10 CF TETRAMEDRON W 10 CF TETRAMEDRON WINTS	~		>	
		RESSES SIGNATY -0.26451939E 0.0	S 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5	RESSES SIGNA-XV -0.26451939E -0.26451939E 0.0
900	æ#	80 4 6 80 8 8 8	22 50 50 50 50 50 50 50 50 50 50 50 50 50	พื้น หู้หู้ เมื่อ รู้รู้
5 g		88. 9. 9. 9. 9. 9. 9. 9. 9. 9. 9. 9. 9. 9.	200 e 800 e	25 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6
		PEMPRANE STRESSES -2 54 E O1 -0.264 56 E O3 -0.264	PEPERANE STRESSES -7 510 0.0 0.0	MEMBRANE STRESSES 948 01 -0.264 566 01 -0.264 566 01 -0.264
	≈ 5	¥	i e	ğ 75
E ELLAIS ELEPENT STRESSES PE PLP 2P ELEPENT TYPE	*	2788	¥	3.48.8
		517.7.2 20.000 20.000 20.000	7-4-9-1	S I 6 PA-Z 2 B 3 6 2 5 6 2 B 3 6 2 5 6
ದ		PEM \$1274-7 0-52836256 0-52836256 0-0	်	NEMI S16PA-1 0.52836256E 0.52836256E 0.0
**	_	88		23
\$14 84	~	***	•	110 (4)
		198-4 1982-4 1982-4		798-1 793.24 192.24
9.99			200	2002 2003 2003 2003 2003 2003 2003 2003
•		444	366 366	444
25				
19 CO EN		2 m	₩ ₩	5 5
LOAD CONDITION NURBER	ezh	S 1004-X 5 1004-X 0.5 2036256 GL	SIGNA-X 0.0 0.0	STRESSES SIGNA-K B. 528362940 0. 528362960
9		NT STRE 83046-X 2636296 2636296	o smes Sigma-k	resses 31674-x 2836296 2696296
ğ			ກ	# 8 W C
104			\$	
		50 47 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5	57.25 57.25 50.25 2.25 3.25 3.25 3.25 3.25 3.25 3.25 3	#ET W.EMENT STRESSES STRESS POINT STGRA-1 L D.5283829 2 0.5269625
		112	925 850 850 850 850 850 850 850 850 850 85	2004 2014 2014

284

(STRESS PCINT CRE EGLALS ELEPERT STRESSES AT CENTROLD OF TETRAHED-ON WITH NUDES(4.2.3.3.1))
(STRESS PCINT THO ECLALS ELEPERT STRESSES AT CENTROLD OF TETRAHED-ON WITH NUDES(4.2.1.4))
(STRESS PCINT THREE ECLALS ELEPERT STRESSES AT CENTROLD OF TETRAHED-ON WITH NUDES(2.4.5.4)) TFIANGULAR W I F STRESSES

	# 0 0 0 0 0 0 0 0 0 0	Ħ	25.5 25.5 26.5 26.5 26.5 26.5 26.5 26.5
	516#3~2K -0,24040375 -0,74319698 -0,27302641E	######################################	00 314420512*0- 00 345461641*0- 10 35250-0-2*0- X7-74513
			555
ນ ບ	Signa- vi -0.666316076 6.268079026 -0.192017608	51 CMA- V2 0 0	30921925 20302028 203020202020202020202020202020202020202
0 1M TS	9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9	3000 300	444 2847
ELEMENT GAID POINTS 7 4 8 0	F 91		260
ENERT A	ESSES SIGMA-XY 0.26359265E 01 0.34160404E 01 0.24345734E07	58 ES 5 1072-xv 5 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6	ESSES S 100 d-xy 0.28554265 0.241005086 0.243477345-07
	STRESS ES S CORA-XY -0.265926 EE 01 0.34100404E 01 -0.24345734E-07	STRESSES S 10 6.0 6.0	STRESSES -0.28554265E 01 0.24160504E 01 -0.2434#734E-07
ELEPENT TYPE	PEMPRANE STRESSES \$160-1 0.47667999 E 01 -0.269 -0.70014328 E 00 0.341 -0.9668394E-06 -0.243	MEMBRANE STRESSES 516PA-2 6.0 0.0 0.0 0.0	NEMBRANE STRESSES 516PA-7 0.47647999E 010.285 -9.70014928E 00 0.341 -0.44643994F-0:0.243
NUMBER ELEMENT PLONER 6	Siepa-y 6, 12741470° C2 -0, 7081386° C0 -0, 188621190-05	8169A-V	\$16#4~\\\0.12741470E\\\C.700138\$\\\C.700138\$\\\C.700138\$\\\C.00\\\C.00138\\\C.00138\\\C.00138\\\C.00138\\\C.00138\\\C.00138\\\C.00138\\\C.00138\\\C.00138\\\C.00138\\\C.00138\\\C.00138\\\C.00138\C.00138\C.00138\\C.00138\\C.00138\C.00138\\C.00138\\C.00138\C.00138\C.00138\C.00138\C.00138\C.001
1086			ជខ3
LOAD CONDITION NUMBER	ELEMENT STRESSES SIGNA-K 0.19733109E CL -0.1402379GE CL	APPL 160 STRESSES S1044-X 0.0 0.0	STRESS SIGNA-X STRESSES STRESS SIGNA-X SIGNA-X S -0.19733185F C1 2 -0.1602370E C4
.	20 20 20 20 20 20 20 20 20 20 20 20 20 2	STREETS STREET	MET BLES STATES FOOT A S

DRCES FER SEE SPRANGULAR PERSE ELEBER

	v			
	Ų			
BLEWENT GRID FOINTS	8			
. O. X	ę,			
ENT S	~			
2 2	und)			
ELEPENT TYPE	t s	6,70089873E OL -0,91694189E OL 0,21602411E OL 0,0	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	62 9.7009073E 01 -0.91691167E 01 0.21602411E 01 0.0
ELEVENT PLPBER	et	F.CFCE & 60007462E 02 -C. 544361 57E C2 0. 1523343E C2 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	7 7 7 7 7 4 7 5 7 5 7 5 7 5 7 5 7 5 7 5	FCACES FY FY C. 40007442E G2 Q. 24436157E G2 G. 0 G. 0 G. 0 G. 0
Ü		0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	૦૦૦૦૦ ઇંત્રેઇઇઇ	0 6 6 4 6 3 0 6 6 4 6 3
ton mures		858		* 858
LOAD COMPITION	~	E. ft ENT FORCES -0.19550746E 0.3538374E 0.19692691E 0.0	APPL IED FORCES 0.0 0.0 0.0 0.0 0.0	MET FLEMENT FUNCES MUTANT N -0.19999746E 2 0.393839746E 3 0.184924916E 4 6.0 5 0.0 6 0.0
		POSM WAS A W	0.4 N. M. W. W. O. O. O. O. O. O. O. O. O. O. O. O. O.	MEY FLEAT PUTM MATERIAL MATERI

PIGURE III-E.20 PORCE CUTRUT, ELEMENT NO. 1 - SYMMETRIC TRIANGULAR PRISM, CANTILEVER BEAN

and the second of the second o

ELEMENT SALD POINTS 7 & 8 G C G			
- E			
ELEPENT TYPE 51	F2 -0.11977249E G2 U-11978271E D2 -0.12207031E-02 0.0	Z, 000000000000000000000000000000000000	F2 0.11977249E 02 0.11978271E 02 0.0 0.0 0.0
FLEPROT ALPRES	FCSCE C FC FC FC FC FC FC FC FC FC FC FC FC F	ng ag ag ag ag ag ag ag ag ag ag ag ag ag	FCPCES F1 C. 49647873E C2 -0.19628373E C2 0.0 0.0
LOAD CONDITION NUMBER	APPAR ENT ELEMENT FORCES POINT 1 -0.1400E379E C2 2 -0.18615918E C1 3 -0.40828125E-C3 6 0.0 6 0.0	R. EMENT APPLIED FONCES POINT 1 0.0 2 0.0 3 0.0 4 0.0 5 0.0	MET ELEMENY FORCES MET ELEMENY FORCES 1 -0.140883795 C2 2 -0.18083795 C2 3 -0.488281295-C3 4 0.0 5 0.0 6 0.0 6 0.0

FIGURE III-E.21 FORCE OUTFUT, ELEMENT No. 6 - SYMMETRIC TRIANGULAR PRISM, CANTILEVER BEAM

F. SYMMETRIC SHEAR WEB

A two-bay cantilevered box beam is idealized by use of the symmetric shear web, axial force and quadrilateral shear panel finite elements and serves as the fifth example problem. structure is shown in Figure III-F.1. with the attendant loading, idealization, dimensions and material properties. The preprinted input data forms associated with this example problem are given in Figure III-F.2 to III-F.10. Note the manner in which the boundary conditions Figure III-F.6 are imposed in this example. degrees-of-freedom are fixed through use of the MODAL card. then the exceptions are designated on the following cards. The REPEAT option is used to advantage here also. A comment must be made here with respect to the symmetric shear web element. The plane of symmetry used for this element must always be the global XY plane thus the element is criented perpendicular to this plane, and z = Z. That is, the local z coordinate of the grid points which define the element are identical to the global 2 coordinates of these same points.

The following load data is evident by inspection of Figure III-F.7, External Loads Section.

- 1) One load condition is input
- 2) The external applied load scalar is zero
- 3) Grid point δ is loaded with a force in the positive Z direction equal to 1000.0 pounds.

Note that no entries corresponding to External Moments are made since the elements used in the idealization do not accomodate such loadings.

Note that external element input data are needed for the finite elements used in this example. The axial force elements require cross-sectional area, the symmetric shear web and quadrilateral shear panel elements require thickness. These data are shown on Figure III-F.9.

The output supplied by the MAGIC III system for this particular example is described below and shown in Figures III-F.11 to III-F.12.

Figure III-F.11 shows the matrix abstraction instructions associated with this example. A complete description of these instructions is provided in Reference 5. Figures III-F.12 to III-F.15 display the output from the Structural Systems Monitor. These figures record the input data pertinent to the problem being solved.

Figure III-F.12 displays the problem title and material data output. The grid point coordinates, temperatures and pressures are given in Figure III-F.13. In addition, boundary condition information and finite element descriptions are also shown on this figure. In the boundary condition portion of the figure, zeros ('0') represent degrees of freedom that are fixed (i.e., no motion), ones ('l') represent degrees of freedom that are free or have unknown values of displacement, and two's ('2') represent degrees of freedom that are eliminated in the analysis procedure through the condensation technique. The second last column represents the cumulative number of degrees of freedom which actively participate in the equation solving process for displacements. The last column accumulates the number of twos which participate in the calculation of the reduced stiffness matrix which is not used in the present example. Figure III-F.14 shows the finite element description. Each of the elements is called out in turn with grid points, print options and material number. Note that extra grid points are needed for the axial element in order to define the orientation of the local axes system for this element. The section properties previously discussed are also listed in the right hand column of the figure.

Figure III-F.15 displays the external load condition and the transformed external assembled load column. This 42 x 1 vector is the total unreduced load which is read row-wise. The ordering of this vector is consistent with that of the boundary condition table

given in Figure III-F.13. Note that a load of 1000.0 pounds is applied at node point 6 in the positive global Z direction. This is position (33,1) in the load vector which corresponds to the thirty-third entry in the boundary condition table which is the global w displacement for node point 6.

MAGIC III system output of final results are displayed in Figures III-F.16 to III-F.24. Figure III-F.16 shows the stiffness matrix for this problem. It is noted that only the non-zero terms are displayed. The stiffness matrix is presented row-wise and its ordering is consistent with that of the boundary condition table previously discussed. In this problem the ordering is

$$\{\Delta\}^{T} = [u_3, v_3, w_3, u_4, v_4, w_4, \dots, u_6, v_6, w_6].$$

The externally applied load vector (GPRINT OF MATRIX LOADS) is presented in Figure III-F.17. This figure shows that a force (F_2) is applied in the positive global Z direction at node point 6.

The displacements and reactions of the cantilever beam resulting from the above loads are given in Figure III-F.18. It is noted that the displacements $(U,\,V,\,W)$ are output corresponding to node point number and are referenced to the global axes unless otherwise specified. The second portion of Figure III-F.19 shows the reactions $(F_X,\,F_Y,\,F_Z)$. These are also output corresponding to node point number and are referenced to the global axes system unless otherwise specified.

The stresses arising in the structure are displayed in tabular form in Figures III-F.19 to III-F.24. Stress data for the axial force elements, elements 1 to 6, are referenced to the element coordinate system and defined to be the axial force acting at the two grid point connections. Figure III-F.19 presents typical results wherein stress points 1 and 2 correspond to the element end grid points.

Six stress value headings are printed for the apparent element stress, element applied stress and net element atress categories. The apparent stress arises from element deformations and the applied stress arises from pre-strain and thermal effects. The net stress is the difference between the apparent and applied stress values. In this instance only the axial heading has entries, the remaining headings are used for the frame element. (See Reference 5 page 227.)

Stress values for the symmetric shear web element are typically presented for element one in Figure III-F.20. The membrane shear stress is listed for each of the three categories for one element stress point, that being the centroid of the element. These stresses are oriented to the local axes system. The final set of stresses are typically displayed for element thirteen in Figure III-F.28 for the quadrilateral shear panel elements and are tabulated in the same fashion as in the shear web element.

The last set of output is given in Figures III-F.22 to III-F.24 which displays the element forces for each of the three elements. These forces are given in the global system. The force points correspond to the end points of the axial elements. In element one, for example, force point 1 corresponds to grid point 1 and force point 2 to grid point 3. Data for the remaining element types is presented in the same fashion.

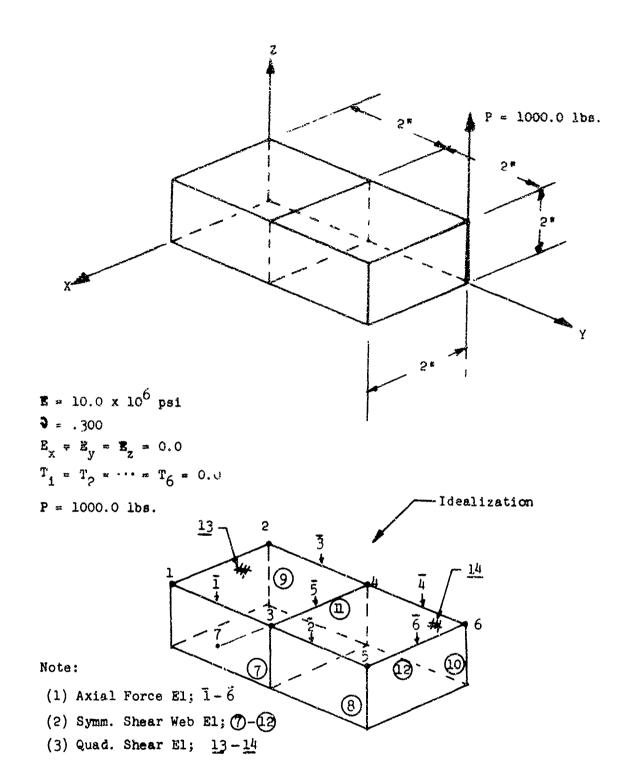


Figure III-F.1 Box Beam With Symmetric Shear Web Element

BAC 1913

Magic Structural Ahaliybis system Hiput Data Põrmaat

TITLE INFOMMATION

THIS IS THE FIRST ENTRY OR ALL REPORT FORM HERST RUMS AND IT IS REQUIRED FOR ALL PURS. HUMBER OF TITLE CARDS mariant (/)

3 () () **\$ /)** 3 **?** 8 /) -() SYNDERICKET SPIEDE NEW MED SPIEDE SEEDE PANEL MAD MEDICAL PRINKE BASE HENDER TITLE INFORMATION - SYMMETRIC SHEAR WEB, CANTILEVERED BEAM STATES AND MISES. PIGURE III-F.2 293

{ / }

90 1123 4 8 6 7 8 9 6 1 2 3 4 MATERIAL TAPE INPUT . dest anti-1 Dates \$ MAGIC STRUCTURAL ANALYSIS SYSTEM * * \$ INPUT DATA FORMAT \$ Orquencetes 2 3 45 6 7 8 6 0 1 2 3 4 5 6 7 6 5 0 1 42 MATERIAL IDENTIFICATION MATERIAL PROPERTIES TABLE Leak Code MATERIAL MIMBER -- 6 0 0

BAC 1619-1

*

(/)

MARK DENEMTY

		3	3	3	3	3	3	{ / }	3	3	3	:	3	
	N													
1 3	-													
100	*6													
J ∑														
				_							\Box			
ROOTY			<u> </u>	<u> </u>									lacksquare	
1 2		\vdash			_	_		_						
Įž	-						Ĺ							
	5			-		-	-				-	-	 	
vet:	Serio	F	F	ğ		لسببا	<u></u>			لــــا		l	آــــا	
	~	S	<u> </u>											
EXPANSION		-				-	 		-		-	-		
1 2	90	W		-			_				7			
125			_				-					_		டி
1														鬲
TORPAGE E	-													
123														5
1 5		3												圓
F	133	19								L			Щ	ES
	44	نيسا	لبيا	ليا	نـــا	لبسا	لــــا					لسا	لـــا	••
consist.	DMC	¥	ř	ž										SYMMETRIC SHEAR WEB,
	~													E
ĺŻ	-													Ħ
MATIO	40													党
≨	788													34
	-			_							-			
1 2								\vdash						1
940980	8	F	-	-				-					\dashv	Ħ
12		200												ďΣ
L	44]	23
uelt	Divis	ر م	2	2										MATERIAL TAPE INPUT CANTILEVERED BEAM
	2													2 8
3		w]					E R
1 8	10													₽
NOOME WOORF					\vdash	 		┝┈┥						₹ E
1 -	-			-										居日
₹		0				-		-					\dashv	띕빛
13	8		~	-	_									₹₹
>	-	Ö												2 0
L_	22													
UQÇ3	Direc	×	w.	Ę										ϵ
	~	Ö	₩	- T		ł	1		!	1				FIGURE III-F.3
1	-			ı			ł		!	- 1				3
ש ונ	NO	ਲਂ		Ì										А
TEMPERATURE	20			Ì										H
. ≤							1			Į				வ
	7			[5
				I						Î	}			O
5 F				j			j]		Į.]			E4
TEMPERATURE	3 4 6			ļ			- 1			- 1				
ـــار	لنت			ı		1	ł	J		ŧ	لـــا			

294

1

SYSTEM CONTROL INFORMATION

		ENTER APPROPRIATE NUMBER, RIGHT ADJUSTED, IN BOX OPPOSITE APPLICABLE REQUESTS	S Y S T E M (/)
1.	Number of	System Grid Points	123456
2.	Number of	Input Grid Points	7 8 9 10 11 12
3.	Number of	Degrees of Freedom/Grid Point	. 13 14
4.	Number of	Load Conditions	15 16
5.	Number of	Initially Displaced Grid Points	17 18 19 20 21 22
6.	Number of	Prescribed Displaced Grid Points	
7.	Number of Systems	Grid Point Axes Transformation	23 24 25 26 27 28 29 30
8.	Number of	Elements	31 32 33 34 35 36
9.	Number of Material T	Requests and/or Revisions of Cape.	37 38
10.	Number of Condition	Input Boundary Points	39 40 41 42 43 44
11.	To For Str	ucture (With Decimal Point)	45 46 47 48 49 50 51 52 (/)

FIGURE III-F.4 SYSTEM CONTROL INFORMATION - SYMMETRIC SHEAR WEB CANTILEVERED BEAM

COOMD (/)

GRIDPOINT COORDINATE

										_			D	 	1	R		 E	Ç	•	Ţ	1	()	N		<u> </u>				·····				
	FIG Nu							>	(_	R					Y - Q												Z	~	. ;	Z				
7 8	9	0	1	-	-	-	3	~	7			0	ę	_	_		6	6	7	8	9	3	1	•	-	~~	6	e	7	8	9	4	1	2	
4	L	L	Ĺ			Ŀ	0	L	Ļ	L	L	Ļ	L	_	0	ŀ	0		L	L	L	L	L	L	2	,-	_				L	L	L	_	ļ
_	L	Ļ	L	2	•	-	þ	7-	Ļ	Ļ	Ļ	L	L	L	0	?	1-	7	L	L	<u> </u>	L	L	L	2		7-1		4		_	L	L	_	۱ ا
+	L	Ļ	Ļ	3	2	Ŀ	0	1	Ļ	ļ.,	L	ļ.,	Ļ	L	2	_	P	•	_	L-	L	L	Ļ.	Ļ	\$	_	9	_	_	4	_	L	Ц	Ļ	۱ إ
4-	L	L	Ļ			<u> </u>			1	L	L	Ļ	-	L	•	Ŀ	0	L	L	L	L	L	ļ.,	L	2	_	9	4	4	_	_	L	Ц	<u>L</u>	١,
4	_	L	L	3	2	Ŀ	0	-	L	L	L	L	L	Ļ.	8. –	Ŀ	2	-	L	L	L	L	L	L	_		9	4	4	_	Ļ.			L	١
+	Ļ	Ļ	1			Ŀ			L	-	L	L	-	L	***	<u>.</u>	•	•	L	L	L	L	-	L	2	٠	9	4	4		_	\sqcup	Ц	<u> </u>	ļi
4	L	L	L	1	۲	Ŀ	0	L	L	L	L	Ļ	L	Ļ	2	ŀ	P	 -	L	L	L	L	-	L	3	Ŀ	9	4	4	4	L	L	Ц	<u>_</u>	(
+	L	╀	-	L	L	L	-	-	L	L	L	Ļ	L	L	-	L	1	L	L	Ļ	L	L	-	_	Н	L	Н		4	4		H		_	۱ ،
+	-	\vdash	-	 	-	-	-	-	Ļ	-	 	L	L	L	L	L	-	-	<u>_</u>	-	-	L	L	H	Н	L	H	4	4	4	L	H	Н	<u> </u>	(
+	\vdash	L	H	-	Į.	1	Ļ	L	-	L	L	1	L	-	L	L	1	-	H	L	H	L	L	L	Н	Ļ	Ц	4	4	4	_	Н	Н	L	(
+	-	┞	-	-	ļ.	ļ_	_	-	\vdash	<u> </u>	-	L	L	L	L	L	L	L	L	Ļ	H	Н	ļ.,	-	Ц	Ц	├ ┤	4	4	4	_	Н		-	} '
4-	-	┞	Ļ	<u> </u>	L	L	-	-	L	L	L	L	_	-	L	ļ.,	L	L	L	L	L	L		L	Н		Ц	-	4	4	_	Н	Ц		ľ
+	-	Ļ	-	H	-	L	L	\vdash	-	L	L	Ļ	L	H	-	L	-	L	L	_	-	-	_	L	H	Н	Н	-	4	4		Н	_		(
╁	-	-	L	H	L	L	L	-	-	-	L	<u> </u>	-	L	L	-	L	L	Ļ	H	Ļ	H	Н	H			Ц	4	4	4		Н	4	_	۱ (
+	 -	-	-	-	L	H	L	┞	┞	-	_	L	L	L	L	-	L	-	L	L	L	Н	-	H	_		H	-	4	4	_	Н	-	_	١
+-	-	-	L	_	L	L	L	L	L	Ļ	H	L	-	L	L	-	Ļ	L	L	Н		Н	-	Н		Ц	-	4	4	4	-	Н	4		(
+	-	-	L	L	L	-	L	L	L	L	L	L	L	ļ.	_	ļ.,	L	_	L	Ц			Ц	Н		_	H	4	+	4	_	Н	-	_	1
+	L	H	L	Ļ	H	H	-	L	L	L	_	L		H	L	-	-	L	H					H	-	Ц	-	4	+	4		Ц	4	-	(
+	┝	-	\vdash	H	-	-	-	-	\vdash	-	\vdash	-	-	H	H	H	-	L	Н		Н	Н	Н	H	H	Ц	+	+	4	-	_	Н			
+	-	-	-	L.,	-	-	L	-	-	<u> </u>	\vdash	-	H	<u> </u>	L	H	-	H	H	Ц	Н	Н	Н	Н	Н	4	4	+	4	4	_	Ц	4	4	ľ
+	-	+	-	_	\vdash	-	ļ-,	\vdash	\vdash	\vdash	\vdash	\vdash	\vdash	H	L	\vdash	-	-	H	Ц	Ц	Н		Н			4	+	+	4	-	Н	-{	-	ľ
+-	-	\vdash	-	۱.,	H	-	-	-	-	-	-	-	Н	Н	\vdash	Н	\vdash	Н	Н		Н	Н	-		\dashv	-	+	+	+	+	-	H	4	-	,
+	\vdash	┝	\vdash	-	\vdash	-	\vdash	-	-	\vdash	Н	H	\vdash	_	H	Н	H	H	Н	Н	_	\dashv	\dashv	Н	4	4	+	╁	+	+	-	Н	+	4	(
+	-	\vdash	\vdash	Н	\vdash	-	-	-	-	\vdash	\vdash	H	Н	Ч	Н	Н	Н	Н	H	4	Н	\vdash	4	Ц	\dashv	4	+	+	+	+	-	\dashv	┥	\dashv	1
+	<u> </u>	-	-	-	\vdash	L	H	-	L	\vdash	H	Ļ	Н				Н		Ц	\dashv	\dashv	Ц	-	Н	4	4	+	+	+	┩	-	\sqcup	<u> </u>	-	1
+	_	H	H		L	-	Ļ	<u> </u>	\vdash	H	H	H	Н	H	H	H	H	-	Н	4	-	\dashv	-	Н	-	4	+	-	+	4	-	H	+	-	1
H	-	<u>_</u>	Н	Н	Н	\vdash	H	-	_	L	H	-		H	H	H	Н	Н	Ц	-	Н		\dashv	Н	4	4	+	+	+	+	-	4	+	4	(
H	L	H	Н	H	Н	Ļ	H	-	H	Ц	Н	H	Н	Н	Н	Н	Н	Н	Н	_	4		4	Ц	4	4	+	+	+	+	\dashv	4	+	-	(
Ц		L			Ц		Ц	L	Ц			Ш	Ш				Ц									_		1	⊥	1			1	ل	(

FIGURE III-F.5 GRIDPOINT COORDINATES - SYMMETRIC SHEAR WEB, CANTILEVERED BEAM 296

BOUNDARY CONDITIONS

IMPUT CODE - 0 - No Displacement Allowed 1 - Unknown Displacement 2 - Known Displacement

2	2	3	4	3	1	
9	0	Ü	×	0		,

PRE-SET MODE

_					
1	2	3	4	5	
•					
1	0	Ð	۸	L	

TRA	NSLAT	IONS	RC	TATIO	XXS	GENERALIZED			
U	٧	W	Φx	Oy	9:	1	2	3	
13	14	18	16	17	18	19	29	21	
0	0		0	0	0				

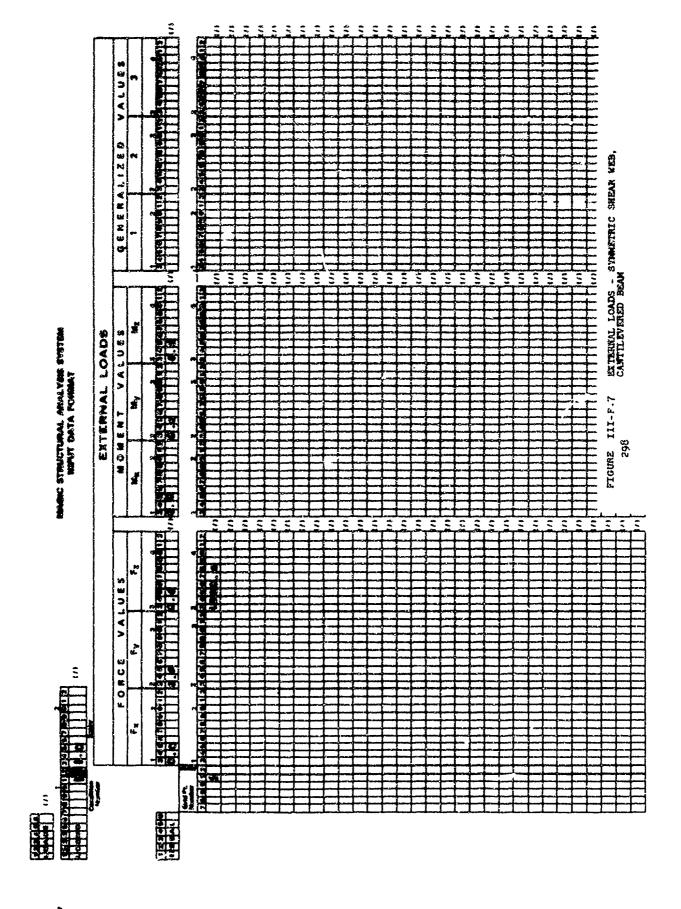
] (/)

LISTED INPUT

0	N	d i	, O	nt er										
7	8	•	Š	_	_	-13	14	18	15	17	18	19	20	21
7	L	L	L	3		1	1							
		L	L	9										
			L	5	X									
				6	X									
			Ĺ											
	L	L	L											
i														
	Γ			Г	П									
	Γ		Γ		П									
1	Γ			Γ	П									
1		٢	Γ	Γ	H									
		Γ	Γ	Г	H									
1	H	\vdash		\vdash	H									

FIGURE III-F.6

BOUNDARY CONDITIONS - SYMMETRIC SHEAR WEB, CANTILEVERED BEAM 297 297



Ĭ

RIGHEST CONTROL BATA MAGIC STRUCTURAL ANALYSIS SYSTEM INPUT DATA FORMAT etalegretal pallag MATERIAL <u>S</u>

Haborus Themsas

8

		كسة						_	_	_	_	-					سسما	_			-
i .			L	I	<u></u>	l			I	L					L			L			Г
	=	~																			L
ł	Ì	0			1	Г			1								_			7-	Г
	AND DESCRIPTION OF THE PERSON	-		****			-	_	-				_			-	_	-		_	*
1	9	-	-	-		1		_		_						-					┢
	-	-	-	-	†	-	-		-	_	-						_	 	-	 	┰
1	-	7	-		*****	-					-	-				 -	-	<u> </u>		} -	} —
•		-			-		-	_			-		·						├ ~~	├	┢
1	-	-	<u> </u>	 -	 		-			ļ	_				-		.				ļ
		40		i	_	-	_									L				<u></u>	٠.
		0			I			Ĺ.,		L							<u></u>	L		L	L
-					Γ-											1			T		Γ
=	}	-												_				_		1	Т
_	-	0	-	-		-		-	_			_	_								1-
0	١ .	-				-	-				_			·	-			 	 	╆~~	† −
		-		}	•					_	_								┪	 -	۳
•		À		-		-	_	-	-	-	-		-					-		┿	┿~
	l _			├	-		-		-		<u> </u>		-		-	-	 -		h		ļ-
	•		 -	ļ	-		-					ļ									╂~
		أمحما	-	-		-			<u></u>			-	_	-	-				ļ	-	-
	ł	40		<u></u>	<u></u>		<u> </u>			—			<u> </u>	L			ļ			├	Ļ.,
₩	•			L													<u> </u>			<u> </u>	L
	L.,	į																	I	L_	L
0		-													7	Œ	_	_		1	Ţ
2	*	-3	-		•			-							_						~
_	ľ	-		-	_	_				_		_		-						<u> </u>	۲
	-			15	K		*	K		-					45	5			-	₩	╆~
	_	-			-	-	-		 i				<u> </u>			_		├			┿
i	•			<u> </u>						_	-			-		ļ		L	 	↓	↓_
	-	6			-	_	_	-	-				_	_	-				L		ــــ
		-	100	37	5	7	2		A	3	J.		12	7	<u> </u>	LID.	ļ	<u> </u>	L	<u></u>	L
		70												<u> </u>					<u></u>		L
													_							ļ	_ـــــــــــــــــــــــــــــــــــــ
	Ĭ			(4)	45		2	3			2		1	רם	-	100			<u> </u>	<u> </u>	L
l i	**	^																	L	<u> </u>	L
		73																Γ_		1	Γ
-	Shall							-				_				-		-	-	┪~~~	Т
1000	NO. 18 AG	*																			Γ
1000	NO. 18 AG	*		25	65	Š		-	6.5	K	7		28		4	-					-
100	NO. 18 AG	*		25	65	5	*	ě.	8 3	5	3	-4	~	a	Ŧ	7					
384	Momber James II No. 34 Ac	3 0 38	6	3)	3	3		8	8	8	 	-14	73	ત	Ŧ	7					
300	Homber Me	*	6	n	6	S	6 6	3	8	8	2	-4	A	a	*	3					
42	Homber Me	22 3 3 S	6	20	3	6	8	13	8	6	1	4	A	ત	3	3					
42	110 % 110 % yed molt all benefit	3 0 38	6	E)	3	G	6	K	8	6	.	4	4	ત	*	3					
42	Fold Sheep To 11 Momber Momber Momber Momber Momber Momber Momber Momber	36 5 8 35 16	6	S	33		8	K	8	6	.	7	71	ส	*	F					
PRINT SE	110 % 110 % yed molt all benefit	36 5 8 35 16	6		3			E	8	2	7	4	A.	ส	£	36					
A ANIMA	Faire Rel3 Fair Ile 9 Membre Membre Membre All Least	25 0 K SZ 15 SE	6	50	3	6	8	8	85	8	k		7	ส	*	9					
A ANIMA	Fold Sheep To 11 Momber Momber Momber Momber Momber Momber Momber Momber	35 0 5 05 05 05 05 05 05 05 05 05 05 05 0	es.	(a)	co.			K	8	6	7	4	7	ส	3	1					
A ANIMA S	Eloca, log 1917 1927 1937 1937 1937 1937 1937 1937 1937 193	25 0 K SZ 15 SE	es.		6	G	8	Æ	8	e	2		-A	ส	*	5					
A THIRT &	eni me ila talati talati de ila file me file m	20 30 31 32 SE SE	6		5		8	K	8	8	R	58	-A	ส.	*	3					
A THIRT &	eni me ila talati talati de ila file me file m	20 30 31 32 SE SE	6	3 53	6	6		*	8	6	*	74	4	ส.	*	3					
A THIRT &	Eloca, log 1917 1927 1937 1937 1937 1937 1937 1937 1937 193	20 30 31 32 SE SE	6	3 53	6			8	8	63	2.0	74	4	A	*	7					
A THIRT &	Mopons Digital	* * * * * * * * * * * * * * * * * * *	6		5			K	8		8	-4		A	*	*					
TO S SHIRE	Ropont Deported Managerial Series Ser	SC OF SC 1C OC SC SC 1	6		3	8	6	*	8	6	er -	G	4	A	*	*					
TO S SHIRE	Ropont Deported Managerial Series Ser	ST 9 E 22 15 25 27 25 12 9	6	P	3	6	6	£ .	8	8	e -	4	4	a	*	3					
TO S SHIRE	Ropont Deported Managerial Series Ser	6 67 28 28 31 22 22 35 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5	6	P	3	S	6	6	8	8	E	4	4	ď	*	3					
TO S SHIRE	Ropont Deported Managerial Series Ser	SE 667 28 28 30 30 10 68 68	6	5)	65			6	8	8	E	4	4	ď	*	4					
TO S SHIRE	Ropont Deported Managerial Series Ser	3 6 6 6 7 28 20 30 31 22 34 6 35	6	5.5	5	6	8	£	8	6	3	4	4	a l	*	3					
TO S SHIRE	Ropont Deported Managerial Series Ser	2 3 4 6 67 38 39 30 31 32 34 38	6		5			£	8	6	3	-1			*						
A THIRT &	E COORTE DE LE COO	1 2 3 4 6 6 7 38 29 30 31 32 33 34 35	6		3			6	8			ra .			*	3					
THE PARTY OF THE P	E Special Control of the Control of	2 3 4 6 67 38 39 30 31 32 34 38	6		3		6	*	e	6				as a							
THE PARTY OF THE P	E Special Control of the Control of	01 2 3 4 6 6 7 38 20 31 32 34 5 36	85																		
THE PARTY OF THE P	E COORTE DE LE COO	1 2 3 4 6 6 7 38 29 30 31 32 33 34 35	85	3	E		8			5	3	~	4	d	*	*					
ANIBA E SE	A STANCE OF STAN	01 2 3 4 6 6 7 38 20 31 32 34 5 36	3	3	₹	3	2	ा		5	3	~	4	d		*					
ANIBA E SE	A STANCE OF STAN	16 01 2 3 4 6 6 7 38 29 30 31 32 334 35	3	3	₹	3	2	ा		5	3	~	75	d	*	*					
ANIBA E SE	A STANCE OF STAN	7 8 18 01 2 3 4 8 6 7 38 20 31 20 33 33 38	3		₹	2	2			5	3	~	4	d	*	*					
ANIBA E SE	A STANCE OF STAN	67 8 10 01 2 3 4 6 6 7 38 20 30 31 32 33 35 35	3	3	₹	3	2	ा		5	3	~	75	d	*	*					
ANIBA E SE	A STANCE OF STAN	5 6 7 8 10 2 3 4 5 6 7 38 20 31 32 32 33 38	3	3	₹	3	2	ा		5	3	~	75	d	*	*					
ANIBA E SE	A STANCE OF STAN	4 5 6 7 2 16 01 2 3 6 6 7 38 29 30 31 32 33 36 38	3	3	₹	3	2	ा		5	3	~	75	d	*	*					
THE PARTY OF THE P	NUMBER AND STREET OF STREE	3 4 6 6 7 12 14 01 2 3 4 6 6 7 38 39 30 31 32 33 34 35	6 7	1 12 1 1 1 1 1 1 1 1 1	1 1 1 1 1 1 1 1 1 1 1 1 1	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1			L L L L L L L L L L	1 2 1 2	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	744	7.5	2 4	****						
THE PARTY OF THE P	A STANCE OF STAN	3 4 6 6 7 12 14 01 2 3 4 6 6 7 38 39 30 31 32 33 34 35	6 7	1 12 1 1 1 1 1 1 1 1 1	1 1 1 1 1 1 1 1 1 1 1 1 1	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1				1 2 1 2	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	744	7.5	2 4	****						

22222222222222222

ELEMENT CONTROL DATA - SYMMETRIC SHEAR WEB, CANTILEVERED BEAM FIGURE III-F.8

299

į

* •0 * ELEMENT INPUT **o**n 90 *** . MAGIC STRUCTURAL ANALYSIS SYSTEM INPUT DATA FORMAT ٥ 34567 ELEMENT INPUT - SYMMETRIC SHEAR WEB, CANTILEVERED BEAM 40 . U 5 8 7 900 en en . . 5678 • 80 80 3466789 • FIGURE ILL-F.9 050 0 0 0 080. XXXX 7 8 9 0 1 E leaners. EXTERN (/) SAC 1608-1 300

5 5

5 5

5 5 5

 173

\$ \$ \$

3

\$

MAGIC STRUCTURAL ANALYSIS SYSTEM INPUT DATA FORMAT

CHECK OR END CARD

FIGURE III-F.10 END CARD - SYMMETRIC SHEAR WEB, CANTILEVERED BEAM'

T ES T DG34

TEST WAGIC

STRSTAUCTION SOURCE

STATICS AGENOUM NITHOLY PRESCRIPED DISPLACEPENTS TO O O O O O O O O O O O O O O O O O O		1ESTD00e	TESTODO	16572010		TEST0012	TESTOGIS	100	07001001 • F38400• • • • •	01001011 01001011		USED	15570020	15001631	T#ST0023	LOADS	7550026	1557002.	TESTOLET	75575030		16510033	7EST0034	TEST0035	7ES 10030	- CDO - CDO			SYSTEM	7 ES 1004 Z	TESTODAS	16510048	TEST0046	16510047	34504 VA T	165 10050	TES 1005 1	16510652	
I	STATICS AGENDUM DITHCLT PPESCRIPED		SINSTRICTION		* * * * * * * *						1) UNIT AND (1 > 1) BUEL	PRINT FORMAT FCE TYPE CF	6		* 21 - SHUT.	MINTENSON MATERIA AND ELEMENT	= EN at SSEP.	I EM .A SSEP		,	K.	KO, KNO = XELA . DEJCIA. (SC(5,1),1)	KCO.STIPF B KNO.DEJOIN. (SC (5.11.0)		REDUCED		TIPLY ELEMENT APPLIED LEACS	# FIELA .MCLT. LSCALE	SPURM EXTERMAL LEADS IN 0-2-2	1012	FYEL S.ADD. LGADO	- TLOAD.DEJCIA. (SOLVE TON OI SPIALE PENTS	. STIFF.	TR12 #		-	

FIGURE III-F.11 FORMAT ABSTRACTION INSTRUCTION LISTING - SYMMETRIC SHEAR WEB, CANTILEVERED BEAM

و جلاء بيونو

1EST0055 TEST0056 TEST0057	TEST0059 TEST0060 TEST0061	TEST0063	TESTOGE	TEST0066 TEST0067	TESTOOG B	TEST0070	TESTOO72	TES 7007 4	TESTOOPS	TEST0076 TEST0077	TESTOOTE	TES T0 07 9	TES 70060	
REACTS - KELA.MIII.XC REACTP- REACTS S.BT.TLCAO IF EDIFF.NULL. 9 GO TO IO	PRINT FLEMENT APPLIED (CAES, EXTERNAL LEADS, DISPLACEMENTS, REACYIONS AND INVERSE CHECK IN ENGINEEPING FCRMAT	ELEMENTS MANE 1 OR 2 DEGREES OF FREETCP	GPR EN 76 4. C. F X. F Y. F. Z. P D. P Y. P Z. S.C. F. DFTELA	GPA INT. 4 + 0 + FX+FY+FZ+RY+PY+PZ+SC+ 1-CACS GPR IN TI 2 + 0 - 0 + 4 + 5 - FHE TAX+THE TAX+SC+PX	GPRINT(1, * * FR.FY.FY.FY.PY.PY.PY.OC.TF PRESCHP	FLEMENTS MANE 3 DEGREES OF FPEEDOFF	GPR IN TE 4, FR O. F J. C. PBE IA. C. Fl. O. F3 S.C TR. SFTELA	GPR INTI 4 FR. O.F. Z. O. HETA. C. FILO. F3.SC. 11 CADS	GBR RX 76 R. o. d. G. F. C. WIE IA Y. C. FO. D. FOR SCO. DX	GFR IN 14 hosers corte de Toriès de Flodefsescet mutracif	GENERA TE STREISFIS AND FIFCES	:	STATE OF THE PROPERTY OF THE STATE OF THE ST	
U (J U U (ب ن ر	٠			υU	ວິ	•		U	ນ	U	&	303
520			22	2 2	S &		2	Š	2	2			~ ~	

FIGURE III-F.11 MAGIC ABSTRACTION INSTRUCTION LISTING - SYMMETRIC SHEAR WEB, CANTILEVERED BEAM, CONCL.D.

SYMMETRIC SHEAR REE-GUAL-SPENF PANEL AND AXIAL FORCE ELEMENTS BOX BEAM CANILEVERED WITH TIP LCAD. STATICS APAINSES.

PEVISICAS OF MATERIAL TAPE

ASTERISK (*) PRECEEDING MATERIA IDENTIFICATION INDICATES THAT INPUT EFACE RETURNS WILL NOT RESULT IN TERMINATION OF EXECUTION

0.300000E 00 XY 0.384616E 07 POISSON'S RATIOS RIGIDITY MODULI SHPUT CODE 22 0.100500E 08 2.2 0.6.50000E-05 MATERIAL NUMBER
34ATERIAL IDENTIFICATION ALLPINLP
NUMBER OF MATERIAL PROPERTY PCINTS.... 1
NUMBER OF PLASTIC PROPERTY PCINTS.... 0
MASS DENSITY.... 0 CIPECTICAS DI SECTICAS MING.S PODILI TH. EXP.CCEF. 0.10000Œ C8 XX 0.450000E-C5 MATERIAL PROPERTIES HCISIA38 TENPERATURE T ER PERATURE **်** 0.0 304

C. 3CCCGGE DO

0.300003£.0

OTA EC TIUNS

6

0. 384616E

C

0.36461eE

DIR ECTIONS

TITLE AND MATERIAL DATA OUTPUT - SYMMETRIC SHEAR WEB, CANTILEVERED BRAN III-F.12 FIGURE

NO. DIRECTIONS . 3 AC. DEGREES (F FREEDEP = 2

GRICFCINT CATA (IN FECTANGULAS COCRCINATES)

PRESSUPE	99	0.0	0	000	0.0	0.0	0	0*1	0-	0	0	G.	0.	0	•	Ģ	o.
	. .	O C	, 0	00	O	00	. 0	Ð	.	0	3	0	0	8	9	0	0
TEMPERATURES	999	ç e	0	000	0	0 0	0.0	9 (ဗ္ ု		•		0.0	9 (D (9 (
	- 3	70		~0		10		;	.			-		;	-		
	30200000000000000000000000000000000000	0.2000000E 01		U.20000000E 01		0.200000007		200000000000000000000000000000000000000	TO BRANCOMO O		O. POODBOOK D.	19 2000000000000000000000000000000000000		200000000000000000000000000000000000000	TO PROPERTY.		
				5		5		5	;		5	•		ē	5		
9) }	ទំ		C. 2600000CE CI		C. 20ccoacce		5.400000000			C.4000000CF C			C. T. O. O. O. O. O. O. O. O. O. O. O. O. O.			
ē	;			70				ed Li) }					10	;		
X 0.2000000000		0.0		0.20000cooE 01		0.0		0.209000000			0.0			0.40000000000			
										3	jo:	5					
POINT		~		n		*		ž.			•			ب			

BCLADARY CCREITICA . NEGRM NT 10N

			KAM
	Š		en E
	**	000000	VEN.
	NO. OF THOS		
	Z		CAN
	NO. OF ONES	60540 00	reb,
	a a	004000	E. R. R.
	C		310
	_		TRIC
E			Year
			рў (
			GRIDPOINT DATA AND BOUNDARY CONDITIONS - SYMMETRIC SHEAR WEB, CANTILEVERED BEAM
		0000000	ບ ≵
,	DECREES OF FFEEDOP	0 9 9 9 9 9	BOUNDA
	<u>د</u>	00000 00	ARD
	DECARE	G C ac act act act C	FT DATA
		♥♥ ₩₩₩₩₩	GRIDPOL
		00mmme0	3
			I-F.
			II
	43 0 E8	mg \$4 W 48 KV 49 }~	FIGURE III-F.1

HEVICA PACEFAIRS	သောက္သည္ သည္ သည္ သည္ သည္ သည္ သည္ သည္ သည္ သည္
3344 83	က ဝစ္စစ္စစ္ရပ္စစ္စစ္စစ္ မွာ ရွိရွိနီနီနီနီရီရီ
ÆC 13	ត ននននន ងជំងំជំងំជំងំ ជំងំ
	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
FRTA C ED PES	
	84 4 *
22 69 22	25 4411444

Ş	**************************************
\$	U @ @ U @ @ @ @ U # 3 @
3	
¥	*************
Š	
447.40. C)86	7272722727
***	医复数医复数医神经神经病病毒病
Ĩ	やん ぞうり あちょう トッミア ちこうちょう

PINITE MINERAL DESCRIPTION - ENDORFOLD SHEAR WES, CANTILITIES MEAN PROUNE IXI-P.14

];;;;;;; ENTERNAL LCAC COMPITIONS 1.040 MD.

ë

3 3 9 9 3 ; 6 3 3 3 3 3 ; ; THANSFERPTE ENTERNAL MS FORLED LUAC COLUMN YNAMIDORHED EKTEBBAL ASSENSED LOAD - SYMMETRIC SHEAR WEB, CANTILEVERED BEAM 9: 0 3 3 4. IIİ-F.15 TOCAR

		8	ક	8	8	8	2	5 8	2 2	ŧ	5 &	88	8
•													
		£07.	C. 5&1 53 \$£	ti or d	2076	Č	•1 53	0. 13441 5E 0. 561 53 6E	# Q1	6, 3 24 025E	1521	6. 501538E G. 501538E	1519
		- C. 4£074 &£	Š	- 0 _e 5425346	~C. 4 E076 5E	-0.4867458	~ 6. fe1535E	0.134615E	-0.440749£	ક	-0.115385 -0.581538F	-0. \$41538E	-C. 561538F
	is.										, •	-	
	FORCE	~	•	₩.	_	2	#	1.2	per 18	€°	12	* 27	» C
~	•	81	C	ŏ	*' 9	*:	ĕ	1 O 1 0	** **	0	6 6 n. n.	60	š
>		3	*	9 Fi	200	*	×	* *	n . ♣	2	**	* *	#
•		e # 4	£ 63	-0.1523062	5 3 94	100	0.57442.X	-0.480769-	-0.4667c%	0.96853 <i>č</i> E	-0.48076% -0.48076%	-0.11530% 0.13461%	£ .
13		-0.96153 8 E	-0.1153896	• 0 -	-0.94153E	-c.4 <i>fc</i> 76Æ	•	-0.4 £07 € ¢¢	66	9	9	7	-0.1°236#
	E C	•	u r	ı,	•	าง	w		* 0	•	8 6 ml	w =	ø
S 17 E	FOR CE		-					5 2	₹ 0		# m	~ =	•
		9 9	6	9	6 6	65	9	5 6	8 8	\$	\$ \$	\$ \$	8
		-0.110577E	0.4 3 0749E	0.*62530E	0.139423E GT 0.480769E @5	-0.4807692	-0.961534E	-0.488769E	-0.961536E 0.961538E	0.061736	-0.456764E	0.4807646 -0.480764	-0.061534E
•		5	6	9	1334	400	\$	1193	6196	7			175
•		9 0	•	•	• •	ŕ	•	ė ė	60	ė	•	• •	•
	ŭ	* #	j e.	•	* =	~	•	* 9	m •	•	+ 9	4 9	~
,	FCBCE										_		
		60	2 2	8	8 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	68	8	000	10 2	33	9 9	6. 0.	88
•		C. 961 539E -C.400767E	-C. 961539E -C. 666769E	0.576423E	C. 941 5385 -C.4 00769E	C. 269230E C. 361533E	-e.142308E	C. 941 53 8E	-C.115365E 0.134625E	~C.192366E ~G.192366E	C.400769E C.961538E	-C.488769E	-0.192304E C.304415E
		7	200	928	1961	198	3	3 3	27.	25.7	3 7	5 5	392
•		3 5	မှ ၃	ö	3 3	á J	å	ೆ ಚ	j å	ှ ခု	33	3 4	ફ ડ
9.0	Ä	w 0	5 2	en	m @	4 N	m	N 0	~ •	£ 23	N F	M #	* 21
•	FORCE												
CUICE		28	28	88	2.2	25	8 3	90	28	38	8 8	38	88
3		#. 135423E	6.249230E	0, 5415386 - 0, 142368E	- 0, 110577E - 0, 480744E	- 0, 16133EE	- 0. 561530E - 8. 1923CBE	- 0.400749E 0.440749E	- f. 4 to 7 e s E	0. 561 53 EE	- 0.486769E	0.40074¥E	6. 541 53 FE 0. 561 53 EE
		1 9	22.0	3 7	200	562	105	4.4	A 89	195	3 2		33
		6 6	ě ů	ਹ ਹੈ •	6.9	0 0	0 6	9 9	é d	ઇ ઇ	0 0	٠ و و	ø e
	FUACE	- •	20	₩ •		~ =	- 2		-	2 9	~	4 F	e =
	P		a .	_						()·	_	4	
			•	m	•	•,	•	_	•	•	2	=======================================	77
									307	•			
		9810	9810	9230	9810	0159	0150	4510	9218	0150	9210	015	6510
		0	0	0	•	0	0	•	23	۵	0	0	0

FIGURE III-F.16 STIPPHESS MATRIX OUTPUT - STREETRIC SHEAR WEB, CANTILEYERS) BEAN

*

		9	3	3	9	8	8	0 %
	*	-						
		3	ž	3	3	o	3	3
	¥	0.0	9	0.	0•1	•	0.0	2
		•	J	9	9			5
(7		}				0.0	
ĩ	9	90	9	9	6	9	3	
FX	0.0	9.0	0.0	0.0	9.0	9	0.0	
Š	-	~	m	•	'n	•	•	

GPRINT OF MATRIX LOADS - SDOUTHIC SHEAR WEB, CANTILLEVERED BEAM PIGURE III-P.17

308

CISFLACEPENT PATRIX FOR LOAD CONDITION

42 X 1

>			x	THETAX	THE TAY		Tues as
0.0		9	0.0	0.0	0.3	9	74 - 34 -
0 • 0		6.0	0.0	0.0		3	
0.1655593%- C2	ä	-C. 65216841E-03	0. M 294322E-02	0.0	; 9	\$ 6	
0.16555972E-C2	3	-0.547£3281E-03	0.207055715-02		•	3	
100000	8		30-31-640-640-6	•	9	9	
4-30805431E02	2	-C. #54519C1E-03	0-40009040 E-05	0.0	9.5	9	
0. 308035CGE- C2	3	-C.74508623E-03	0.83991885E-02	0.0	ن	9	
0.0		0.0	0.0	0.0	3	3	
×		<i></i>	23	×	1		;
-0.1541757Æ C3	3	G.11235535E GA	-0.30 833594E 03	0**		•	2
-0.15417577E 53	£.	Co 87€44556€ 03	-0.49 16 6136E 03	0.0		\$.	
-0. 61035136E- C2	Ş	C-20254189E-02	-0 - 36 62 10 94 F-02			e Š	
0.341796 EEE- 02	8	0.24414C63E-03	0.0		ت پ	ર્વ	
				•••	9.5	3	
-0- 14 71 875 CL	5	0.32 C43457E-03	0.26414063E-03	0.0	0.3	9	
0. 4371 653Æ- 02	8	0. 14648438E-02	0.19531250E-02	0.0	ິງ	9	
9		٠ ٠	0.0	0.0	0.3	3	

FIGURE III-F.18 DISPLACEMENT AND REACTIONS MATRICES - SYMMETRIC SHEAR WEB, CANTILEVERED BEAM

	00-0 00-0	h c k p al. (N2)	ACREAL (RZ) Q. G. G. G. G. G. G. G. G. G. G. G. G. G.	
PD IN 75	FLEXURAL MOPENTS MORPAL(MV) C.O C.O	FLEXURAL MOMENTS NORMAL(MY) C-0 C-0	FLEXUMAL MOVENTS MORMAL(MV) C. 0 C. 0	
B.EMENT GAID POINTS	TORQUETHX)	TURQUECHX)	TORQUEENK)	
ELEPENT TYPE	9-0 0-0	SHE #6 (FZ)	SMEPR(FZ) 0.0 9.0	
ELEPEAT PLPES	FCFCES SMEAR (FT) Co. O	FCRCES SPEAR OF VI G. 0 G. 0	FCRCES SWEAR (FV) G. O	
LOAD COMPITION NUMBER	APPARENT & EMENT STRESSES STRESS AXIAL (FX) 1 0.61521045E (3) 2 -0.61521045E (3)	REMENT APPLIED STRESSES STRESS POINT AXIALIFXE 1 0.0	HET ELEMENT STRESSES STRESS MOINT AXIAL(FX) 1 0.61521045E C3 2 -0.61521045E G3	310

FIGURE III-F.19 STRESS OUTHUR, ELEMENT NO. 1 - SYMMETRIC SHEAR WES, CANTILEVERED BRAN

05 171 28 SIFAR SVKKFF T F 14 14 14 STRESSES

(STRESSES EVALUATED AT THE BLONGNI CONTROLOS

ELEPENT TYPE ELEPEAT ALPER LOAD CONDITION NUMBER

BLENENT CATE POINTS

Ş

APPAR BIT BLENGOT STRESSES STRESS POINT HENDRA

HEMBRANE SHEAR STRESS G.3083361 GE GA

ELEMENT APPLIED. STRESSES STRESS POINT MEMBA

MEMBRANE SWEAR STRESS 6.0

NET ELEMENT STRESSES STRESS POINT N

MEMBRANE SMEAR STRESS C. 3C83361 & C.

311

STRESS OUTPUT, ELEMENT BO. 7 - STREETRIC SHEAR WEB, CASTILINERRED BEAM FIGURE III-P.20

THE PERSON NAMED IN

P 1 . E L 7 4 V (STEFSSES EVOLUATED AT ELEMENT CFNT4010) ********** ¥ ¥ ₽ ال ال S 5 T F F S S E

We seem after

ì

ELEPENT TYPE ELEPENT PLPRES LOAD CONDITION NUMBER

,

BLENENT CATO BOTH 15

13

APPARENT REMENT STRESSES STRESS POINT

Hembrane Smear Strees -0.30835161E GA

ELEMENT APPLIED STRESSES STRUKS POINT

MENDAME SHEAR STREET

MET ELENENT STRESSES STRESS POENT

MEMBRANE SHEAR STRESS -0.30835861E ON

312

STRESS OUTPUT, ELEMENT NO. 13 - STREETSIC SHEAR WEB, CANCILLEVERED BEAN PIGURE III-F.21

Į

PUBLES FOR THE FRAME BLEXENT

ELEMENT GAID POINTS

ELEPENT TYPE

ELEPENT NIPREF

LOAD CONDITION NUMBER

~

ACFFAL (MZ)	00°0	RCHPAL (PZ)	9 G 9	ACRFAL (MZ)	မ မ မ ဝီ ဒီ ဇီ
FLEXUNAL MOPENTS NORMAL(MY)	90G 113	PLEXIMAL POPENTS NURMALIPY;	000	FLEXUMAL MOPENTS MOPMAL(MY)	000
TORQUE(HX)	000	TORQUECKX)	000	TORQUE(MX)	000
SHE JR (FZ)	000 000	SHEAR(FZ)	000	S NE 54 (FZ.)	000
FCPCES	0.01521645E C3 -0.01521045E C3 6.0	FUNCES SHEAR (F?)	900 444	FCACES SHEAR (FY)	C. 81521045E C3 -6. 81521045E C3 G. C
MP AR BY B. SHENT FORCES PGINT AXIAL (FX)	999	APPLIED FORCES AXIALIFXI	900	NET ELEMENT FORCES Point Axial (FX)	9 9 9 9 9
# P # EV 7	al (4 (6	B. EMENT POINT	N M	NET ELEN POINT	313

FORCE OUTPUT, ELEMENT NO. 1 - SYNCETRIC SHEAR WEB, CANTILEVERED BEAN

PIGURE III-F.22

F 0 R

ELENENT GATO POINTS				
ELEPENT TYPE 29	FZ -0.30833594E 03 0.30833594E 03	F2 0.0 0.0	F2 ~0~30833594E 03 0~30833594E 03	
ELEPEAT ALPEFF	FCPCES FY 0.154168CGE 03 0.154168CGE 03	FCRCES FY C.O	FURCES FY C.134168CE 03	
LJAD CONDITION NUMBER	APARENT ELEMENT FORCES POINT 1 0.0 2 0.0	APPLIED FORCES FX 0.0	ELEMENT FORCES I 0.0 Z 0.0	314
	Polar Polar 1	BLENENT POINT	NET ELEG POINT	J44

FORCE OUTPUT, ELEMENT NO. 7 - SYMMETRIC SHEAR WEB, CANTILEVERED BEAM FIGURE III-F.23

CUACRILATERAL W X --. FORCES

	Z	1	:	ž	
	4	je d	૽ € • ÷ • • • • • •		****
RENEWT CALLS POSKTS	ACHENTS RY	ACTOR ACTOR	: : ::::::::::::::::::::::::::::::::::	84? 360 6	0 0 0 0
P. ERENT	9 6 4 6		9999	#	4999
PLEPSOT 119E 25	2		• • • •	ž	
ELEPENT POPPER	25. 25. 25. 25. 36. 36.	-6.194(19376 63 -4.194175776 63 FOACES		FORCES	0.15417577E C3 -0.15417577E C3 -0.15417577E C3 -0.15417577E C3
LGAD CONDITION NUMBER		6-15417577E GB -0-15417577E GB -0-15417577E GB -0-15417577E GB	****	NET BLENGAT FOACES PGINT	20 -0.15417577E 43 0.15417577E 43 0.15417577E 43 -0.15417577E 43
	POINT 2	m+ 555	22 M M 4	7 TE B	-NA4

FIGURE 111-F.24 PORCE OUTPUT, RUBHERT NO. 13 - STRATERIC SHEAR WEB, CANTILEVERED BEAM

Contraction of the last of the

A magazine

G. MODIFIED QUADRILATERAL

A four element idealization of a structural joint is shown in Figure III-G.1. This figure shows the loading, idealization, dimension and material properties. The problem is one of those shown in Reference 9 page 329 wherein the effects of the modification of this element were evaluated. The preprinted input data forms associated with this example are given in Figure III-G.2 to III-G.10.

Of interest is the Boundary Condition Section, Figure III-G.6 which shows the use of the MODAL and REPEAT options. There are 8 exceptions to the MODAL card. Grid points 4, 6, 11, and 14 have the same boundary conditions as grid point 1, therefore the option is employed by placing an "X" in column 12 opposite the entry for grid points 4, 6, 11 and 14. The same procedure is followed for grid points 22 and 23. Note the use of symmetrical boundary conditions so that only one-half of the joint need be considered. Note that the eight exceptions to the MODAL card are called out on the System Control Information Data Form, Figure III-G.4.

The following load data is presented in Figure III-G.7, External Loads Section:

- (1) One load condition is input
- (2) Grid points 1 and 3 are loaded with a force in the +X direction equal to 16.67 pounds and grid point 2 is loaded with a force of 66.66 pounds in the +X direction.

Zero valued entries are made in the External Moments section since these do not exist in this problem.

The Element Control Data Form, Figure III-G.8, displays the use of the REPEAT option. This is used to advantage here since each of the four elements are identical. Although 8 input nodes define the element the User will note that 10 nodes are listed. The last two nodes "6" and "1" in locations 9 and 10 define the X direction for the material properties axes. This allows the User to effectively

define stress output direction. The same two points used for the reference element can also be used for the following elements so that output has a common reference.

The output supplied by the MAGIC III System for this illustrative problem is described below and shown on Figures III-G.ll to III-G.27. Figure III-G.ll shows the matrix abstraction instructions which are completely described in Reference 5. Figures III-G.ll to III-G.l4 display the output from the Structural Systems Monitor. These figures record the input data pertinent to the problem being solved.

Problem title and material data are given in Figure III-G.12 whereas Figure III-G.13 displays the gridpoint coordinates, temperatures and pressures. Figure III-G.14 presents the boundary conditions and finite element description. In the boundary condition portion of the figure, zeros ('0') represent degrees of freedom that are fixed (i.e., no motion), ones ('1') represent degrees of freedom that are free or have unknown values of displacement, and twos ('2') represent degrees of freedom that are eliminated in the analysis procedure through the condensation technique. The second last column represents the cumulative number of degrees of freedom which actively participate in the equation solving process for displacements. The last column accumulates the number of twos which participate in the calculation of the reduced stiffness matrix. procedure is not used in this example problem. The second portion of Figure III-G.14 depicts the finite element representation. Each of the four elements is called out in turn with grid points, print options and material number. The use of extra grid points "6" and "1" were explained above. The section properties listed represents the joint thickness.

Figure III-G.15 displays the external load condition and the transformed external assembled load column. This 138xl vector is the total unreduced load which is read row-wise. The ordering of this vector is consistent with that of the boundary condition table, Figure III-G.14. A load of 16.67 pounds is applied at node point one in the positive X direction. This is position (1,1) in the load vector which corresponds to the first entry in the boundary condition table which is the global U displacement for node point 1. Likewise position (7,1) in the load vector corresponds to the seventh entry in the boundary condition table and the last position (13,1) corresponds to thirteenth entry.

MAGIC III system output of final results are displayed in Figures III-G.16 to III-G.27. The stiffness matrix is shown in Figure III-G.16 where only the non-zero terms are displayed. The stiffness matrix is presented row-wise and it's ordering is consistent with that of the boundary condition table previously discussed. In this problem the ordering is

$$\{\Delta\}^T = [v_1, v_2, v_2, v_3, v_3, v_4, \dots v_{21}, v_{22}, v_{23}].$$

The externally applied load vector (GPRINT of MATRIX LOADS) is presented in Figure III-G.17. The figure shows that forces (F_{χ}) are applied in the positive X direction at nodes 1, 2 and 3 as previously discussed.

The displacements of the joint are given in Figure III-G.18. These displacements (U,V,W) are output versus node point number and are referenced to the global axes unless otherwise specified. Figure III-G.19 shows the reactions (F_X, F_y, F_z) . These are also output versus node point number and are referenced to the global axes system unless otherwise specified.

Stresses arising in the structure are displayed in Figures III-G.20 to III-G.23. Eight stress resultants are evaluated at each corner point of the element and also at the intersection of the diagonals which connect the opposite corner points of the element. The stress resultant, are defined as follows:

$$H_{X} = \int_{X} \sigma_{X} dz \qquad ; unitz = \frac{force}{length}$$

$$H_{X} = \int_{Z} \sigma_{Y} dz \qquad ; unitz = \frac{force}{length}$$

$$H_{X} = \int_{Z} z \sigma_{X} dz \qquad ; unitz = \frac{force}{length}$$

$$H_{X} = \int_{Z} z \sigma_{X} dz \qquad ; unitz = \frac{force}{length}$$

$$H_{X} = \int_{Z} z \sigma_{X} dz \qquad ; unitz = \frac{force}{length}$$

$$H_{X} = \int_{Z} z \sigma_{X} dz \qquad ; unitz = \frac{force}{length}$$

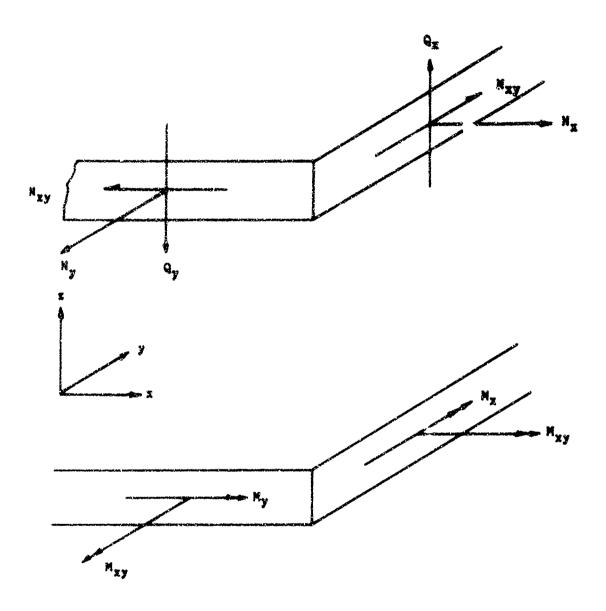
$$H_{X} = \int_{Z} z \sigma_{X} dz \qquad ; unitz = \frac{force}{length}$$

$$H_{X} = \int_{Z} z \sigma_{X} dz \qquad ; unitz = \frac{force}{length}$$

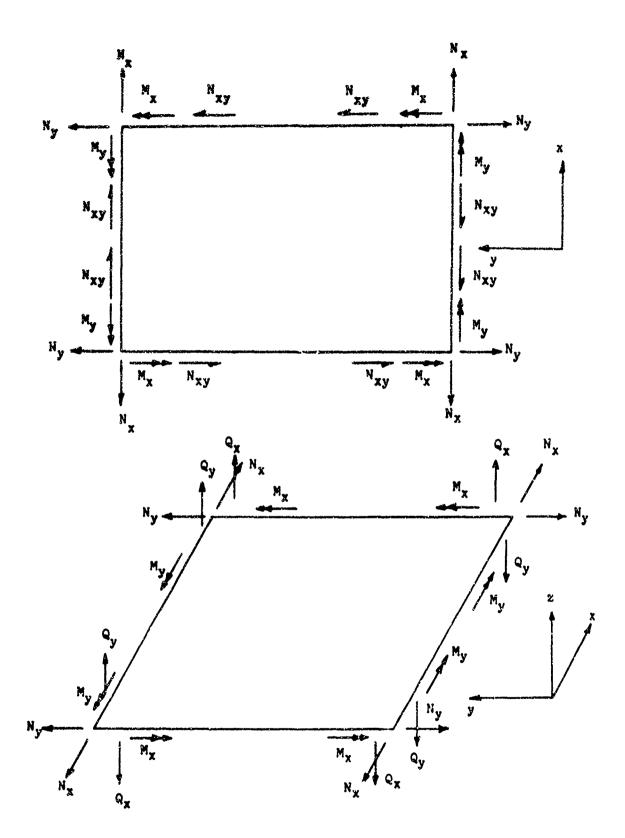
$$G_{X} = \int_{Z} z \left(\frac{\partial \sigma_{X}}{\partial x}\right) dz + \int_{Z} z \left(\frac{\partial \sigma_{X}}{\partial x}\right) dz; unitz = \frac{force}{length}$$

$$G_{Y} = \int_{Z} z \left(\frac{\partial \sigma_{Y}}{\partial x}\right) dz + \int_{Z} z \left(\frac{\partial \sigma_{X}}{\partial x}\right) dz; unitz = \frac{force}{length}$$

The following sketches show the proper assmur in which to interpret the stress resultants.

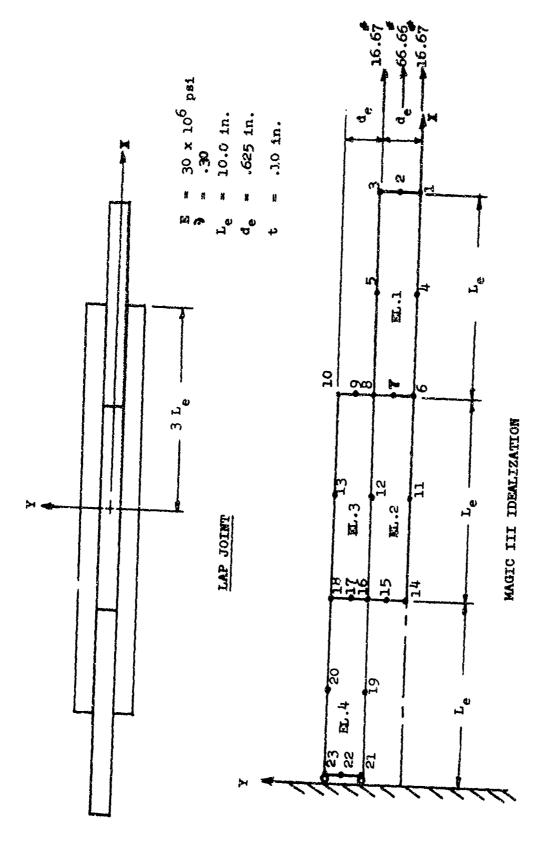


Stress Resultants



Returning to Figure III-G.20 it is noted that there are five stress points at which the stress resultants are evaluated. These correspond to element grid points 1, 3, 8, and 6. The fifth stress point corresponds to the stresses evaluated at the element centroid. The stresses are in general referenced to the element coordinate system. For the quadrilateral or triangular thin shell elements, however, the User has the option of specifying material or stress axes in order to effectively define stress output direction. This is accomplished by utilizing locations 9 and 10 or 11 and 12 of the node point portion of the Element Control Section. In this particular problem the numbers '6' and '1' were entered in locations 9 and 10 of the node point portion of the Element Control Section. These two points define the X direction of the material properties axes. (Positive X from node point 6 to node point 1.) This axis of reference then becomes the reference axis for the stress output.

The element forces for the Modified Quadrilateral Thin Shell Element are displayed in Figures III-G.24 to III-G.27. The forces $(F_X, F_Y, F_Z, M_X, M_Y, M_Z)$ are defined with respect to the Global coordinate system. The forces are defined at eight points on the element. The first four points are corner points, element grid points 1, 3, 8, and 6, and the last four points are mid-points, element grid points 2, 5, 7, 4 for element 1, for example.



MODIFIED QUADRILATERAL THIN SHELL ELEMENT - LAP JOINT PROBLEM FIGURE III-G.1

8 12348478981234867899 TITLE INFORMATION \$ ** THIS IS THE FIRST BUTNY ON ALL MENORT FORM MENUT RUMS AND IT IS RECUMBED FOR ALL MUNS. TITLE INFORMATION - LAP JOINT PROBLEM STRYTES NAME YETS MODESTED BUNDASELAVOIGE TREE SECUL NUMBER OF TITLE CARDS ASPECT MATTER 16.0 III-G.2 S 1 2 2 4 8 8 TITUE REPORT (/) FIGURE 324

2

()

5

()

2

3

12

()

3

()

The second secon

BAC 1876

MAGIC STRUCTURAL AMALYSIS SYSTEM HAFUT DATA POSMAT

BAC 1616-1

MAGIC STRUCTURAL ANALYSIS SYSTEM INPUT DATA FORMAT

MATERIAL TAPE INPUT

		5															
	•																
>	2 3					3	(;)	S	()	5	3	(/)	\$	3	3	<u> </u>	473
5	-						~	<u> </u>	~	<u> </u>			~	~			·
8	• 6	8	j	_	1 2									-		-	H
AAGS DENGITY	7.0	goo		MODUL	•0												
*	3				6 2			-				_		-	_	- -	
		0		MOIDITY	-												
Number of Please Par	3			Ö	-:		-			 	}	 -	 		-		-
Mer'l. Par.	4-				13 60						- LX73-E						
Friest Marti.	8		•	Soles Police		3	ځ	a E		.	<u> </u>	L		L		L	L)
	-				N	_	<u> </u>	9		1	_	<u> </u>		_	_	_	
Potes Mor's. Toble		X		EXPANSION	E												
Police _ abs				, 3 %	90	-	-		 -	 -	-	-		-	-		
areled lainteald	-			5													
altest bbA	8			83	-;		-		_		_		_		-		
Orthoprepie				THE ROAD L		S.		-							—		
Alterials				=	-	46				亡							
Sharefull	2			uep:	2044 (3	¥	ř	ř									
algeneatro	\$			9	2	Γ.											
algewoof	8	×		RATIOS	40												
					8							-					
Ì	78			Š		1											
	- 6			SHOGSHO.	क	10											
]		-	1	•	200	6		-	-	╫	 	-	├─	-	-	-	
8	-		•	neln	eri()	2	2	3 2		-	-		-			***************************************	
TERIAL IDENTIFICATION	- n	-	l		~	3	7	1 2	<u> </u>	T-	Γ-	r	Γ	<u> </u>			
3	F			Ę	80												
E	no			HOOR	-	_	├──	-	-	-	 	-	 		-		
ğ	-																
\\ \\ \\ \\ \\ \	<u></u>			2000	-	0											
Į į	•	_		Ş													
\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\	- 3	병			NH			-	 	├	-	├	-			-	
1	6	188	Ì	uop	Ohrec	×				_			·				·
1	2012	2			N		. w		r	1			1			ì	
}	NO	1			 	-	1			1		┢──	{		-	1	
	*		1 3	Ě	110		1			1			1				
	+=	-	1	1	-	-	1		 	1		 	1				
Leak Code		त	MATERIAL "MOPERTIES TABLE	TEMPERATURE	-					1			1			Ì	
2 =	-;	286	5	1 2	19		Ì		} -	ł		 	1			1	
MATERIAL NUMBER	77	n	\$		-		Ì			1			1				
F 5			اد	L	7])			1)	
3.	-6	-	ž														
Mumber	-:	-	ĮĘ														
Meupañ	1	 	3					325									
	-		4					J J									

MATERIAL TAPE INPUT - LAP JOINT PROBLEM FIGURE III-G.3

MAGIC STRUCTURAL ANALYSIS SYSTEM INPUT DATA FORMAT

SYSTEM CONTROL INFORMATION

		ENTER APPROPRIATE NUMBER, RIGHT ADJUSTED, IN BOX OPPOSITE APPLICABLE REQUESTS	S Y S T E M (/) 1 2 3 4 5 6
1.	Number of	System Grid Points	1 2 3 4 5 6
2.	Number of	Input Grid Points	7 8 9 10 11 12
3.	Number of	Degrees of Freedom/Grid Point	13 14
4.	Number of	Load Conditions	15 16
5.	Number of	Initially Displaced Grid Points	17 18 19 20 21 22
ó .	Number of	Prescribed Displaced Grid Points	
7.	Number of Systems	Grid Point Axes Transformation	23 24 25 26 27 28 29 30
8.	Number of	Elements	31 32 33 34 35 36
9.	Number of Material 1	Requests and/or Revisions of [ape.	37 38
10.	Number of Condition	Imput Boundary Points	39 40 41 42 43 44
11.	T For St	ructure (With Decimal Point)	45 46 47 48 49 50 51 52 (/)

FIGURE III-G.4 SYSTEM CONTROL INFORMATION - LAP JOINT PROBLEM

MAGIC STRUCTURAL ANALYSIS SYSTEM INPUT DATA FORMAT

1 2 3 4 8 8 C O O P D (/)

GRIDPOINT COORDINATE

															D		 i	R		E		C		T			0)	N	- ;	S								
•		ld lu		isul er	l					X	_	-	R								Y			0								Z		- ;	Z				
7 8	3	9	0	9	2	3	4	~	-	_	7	3	9	20	1	2	3	4	ا ا			_	~	7)	3	1	~	33	4	5	6	7	8	9	40	1	2	
Ц	1	_	_	L	1	L	L		\$			9	_	L	L	L	L	Ļ	1	-4	0		þ		1	1	4			L		L	L	L	L	L	L	L	(/
4	1	_		L	3		L					0		L	L	Ļ	L	Ļ	1		0		6		ļ	4	4	_	_	L		_	L	L	Ļ	┞	L	L	11
4	1	_	L	L	6	٠.	L	£	*	-		0		L	L	Ļ	Ł	Ļ	ļ		-	٠			1	1	4	_		_		L	L	L	L	Ļ	L	L	11
4	4	_	_	L	8	7	ļ.					0	L	L	Ļ	Ļ	L	╀	4	~7	0	_	6	7-	7	4	4	_		L	L	L	L	L	L	L	L	-	11
4	4	4	_	,	9	L	L		4				ļ.,	ļ _	L	L	1	1	4			٤			4	4	4	_		L.	ļ.,	<u> </u> _	L	L	L	L	L	Ļ] (/
Ц	1	4	_	_	1	L	L	-	~	_		0	_	_	L	L	L	1	1	~+		•	•	+-	1	4	4	_		L	L	L	L	<u>L</u> .		Ļ	L	L	1 11
4	1	_	L	~	6	L	L	•	٠,		_	0	1	L	_	L	L	Ļ	ļ	-+	~	,	É	2	¥	4	4	4		L	L	L	L	L	L	L	L	-	1 11
4	1	_	_	۰	7	L	L	ľ				0		L	L	Ļ	L	╀	ļ	-	١	e.	2	E	4	4	4	4		ļ.,	ļ.,	L	L	L	-	Ļ	L	L	11
4	+	4	_	3	Î	1	L	ļ				0		L	1	-	1	1	+	-	0	٠	þ		¥	4	4	_		L	Ц	L	L	Ļ.	L	Ļ	L	<u> </u>	11
4	4	_	-	2	3	L	L	ļ	+	g	٤	0	_	-	1	-	Ļ	ļ	1	4	l	٠		E	\	4	4	4		L	L	L	-	Ļ	L	L	_	L	11
4	4	4		L	L	L	L	╀	4	4			L	L	L	-	L	Ļ	1	4	_	_	L	1	1	ļ	4	_	L	_	L	L	L	Ļ	L	Ļ	L	L	11
4	+	4	_	L	-	L	Ļ	ļ	4	-	-		Ļ	L	Ļ	L	-	╀	1	4		L	L	╀	╀	4	4	_	لِـا	ļ.,		_	L	L	L	Ļ	L	L	''
+	+	4	_	L	L	-	Ļ	╀	4	4	_		ļ.,	L	Ļ	L	ļ.	1	+	4	-	_	L	╀	1	4	_	4		Ļ.	L	Ļ.	L	L	L	Ļ	L	L] ''
+	+	4	_	L	L	L	L	ļ	4	4	4		L	L	_	L	L	╀	ļ	┩	4	Ļ	Ļ.	╀	+	4	4	4		Н	_	L	_	L	L	Ļ	L	 -	1 1
4	4	_	ļ.,	L	_	L	L	ļ	4	4	4	L	L	L	L	┞	Ļ	╀	╁	4	4	-	L	╀	+	+	4	4			Ļ	-	L	L	L	L	L	<u> </u>	1 1
4	4		L	L	_	L	1	╀	+	4	_	Ц	L	-	Ļ	Ļ	L	+	ļ	4	4	-	L	Ļ	4	4	4	4		_	Ц	-	L	L	-	Ļ	Ļ.	-	. ۱ آ
+	+	4	_	L	L	Ļ	Ļ	ļ	4	4	_		L	L	L	-	┞	╀	ļ	4	_	ļ	L	╀	+	+	4	_		_	Ц	_	Ļ	L	-	Ļ	L	Ļ.	''
4	+	_	_	L	L	L	L	ļ	4	4	4	Ц	_	L	 	L	L	Ļ	+	4	4	-	L	╀	+	4	4	\dashv			_	L	-	L	L	╀	L	├-	'
+	+	-	_	L	H	┞	Ļ	╀	+	-	4		-	Ļ	┞	L	┞	Ļ	+	4	4	_	L	╄	4	+	4	4		Н	Н	_	Ļ.	L	L	L	L	-	(
+	+	4	H	-	<u> </u>	L	\vdash	+	+		4	Ц	L	L	Ļ	\vdash	Ļ	╀	+	4	_	L	-	Ł	+	+	-	4	Ц	Ļ.	Н		L	İ–	-	-	L	L	1 .
+	+		ļ	-	L	-	\vdash	+	+	4	4	L	-	-	-	-	-	+	+	4	4	L	ŀ	+	+	+	4	4	Ц	L	Н	ļ.,	-		-	╀-	-	L	1 ()
+	+	-	-	H	-	H	\vdash	╀	+	\dashv	-	H	L	\vdash	\vdash	┞	┞	╀	╬	+	-	-	L	╀	╀	+	+	4		Н	Н	-	\vdash	L	 	╀	┡	L	1 1
+	+		L	L	-	-	-	+	+	4	4	-	_	-	-	-	╀	Ļ	+	+	-	L	H	╀	+	+	+	4	4	Н	Н	H	L	L	ļ.,	H	-	L .	1
\dashv	+		_	-	_	\vdash	-	ł	+	-	-	_	-	L	L	L	╀╌	╀	Ŧ	+	-	-	L	╀	+	+	+	4			H	L	<u> </u>	ļ	<u> </u>	L	-	\vdash	1
4	+	_	-	ļ	L	H	-	ļ	4	4	4		L	-	-	\vdash	1	ļ	╁	+	4	_	-	╀	+	4	4	4		Н	Ц	H	Ļ.	<u> </u>	<u> </u>	 _	L	-	1
+	+		_	L	-	-	-	+	+		4	H	L	-	-	-	┞	+	+	Ļ	4		-	╀	+	+	-	-		Н		\vdash	Ļ	-	_	 	L	Ļ	1
+	+	-	H	-	 	-	╀	+	+	4	4			L	1	L	L	╀	+	+	4	-	\vdash	╀	ļ	+	4	4	Н		Н	H	L	-	-	L	-	-	1 1
+	+	-	_	-	<u>_</u>	-	+	+	+	4	-	Н	-	-	\vdash	-	┞	╀	+	+	4	-	H	+	t	+	4	4	4	Н	Ц	L	-	-	<u> </u>	1	Ļ.	-	1
	1	_	Ļ	L	_	L	L	L	1			Ц	L	L	L	L	L	L	L	1		L	L	L	L	\perp	1	╝		Ш			L	L	L	L	L	L	J (

FIGURE III-G.5 GRIDPOINT COORDINATES - LAP JOINT PROBLEM 327

£

MAGIC STRUCTURAL ANALYSIS SYSTEM .NPUT DATA FORESAT

BOUNDARY CONDITIONS

INPUT CODE - 0 - No Dispissement Altowed 1 - Unknown Dispissement 2 - Known Dispissement

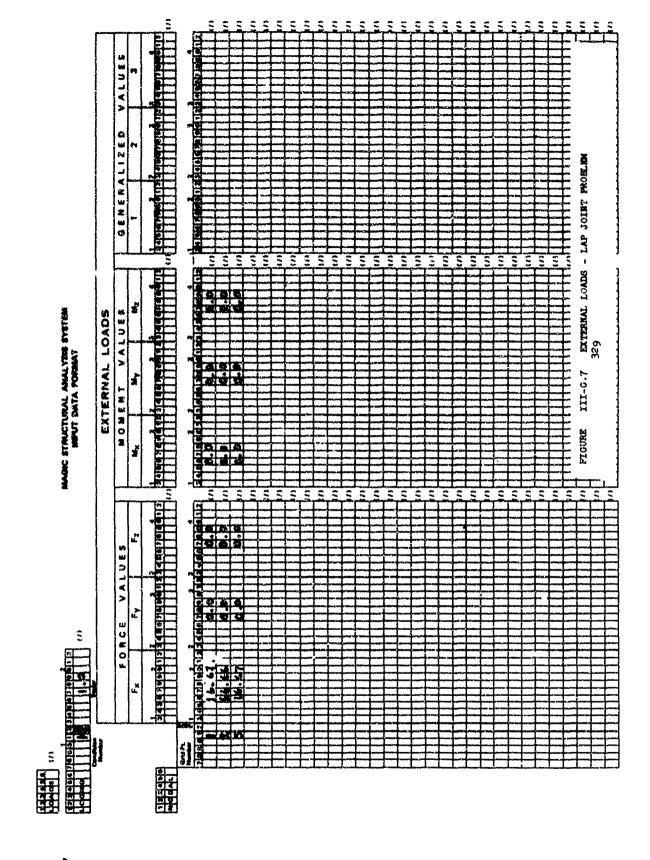
PRE-SET MODE

4	_	-	_	_	-	-
1	1	2	Ð	3	3	•
	M	0	D	A	L	
i	~'				_	ı

TRA	NELAT	IONS	RO	TATIO	XVS	GE	YERAL	ZED
U	٧	₩	@x	θy	0 2	1	2	3
13	14	16	16	17	16	18	2 0	21
1	1	0	0	0	0			

LISTED INPUT

j	nt Y	Ž										_
å		i	13	14	15	16	17	18	19	20	21	
			1	0	0	0	0	٩] (
	4	X										1
	2	X										1
1	ı											1
1	4	X										1
2	1	П	0	١	0	0	0	0				1
9	4	×										1
3	3	X										1
		П										1
		П										١
Γ		П										١,
		П									-	1
		П										1
		П										١,
		П										١,
	Ι	П										١,
												١,
T	Γ	H										(
M	٢	H										,
T	Н	H								· · · · · ·		(
	Η	- 1										,
		-44-4-4	4x 4x 14x 24x 24x	4	1							



PAC 1627

7 8 9 × 123467 -9 Po w 0 • • - 60 A 9 × MAGIC STRUCTURAL ANALYSIS SYSTEM INPUT DATA FORMAT to teamble too. Heati .me13 PRINT F 14144 8 fren lasel R × mel# taego fi goshtabi 8 X × 21234567 0.0 MATERIAL POST CONTEMPERATURE 2 3.6 MATERIAL RUMBER 1 ON BATE 7 000 MANOEN EFERENA

3 ~

40/7/06

=

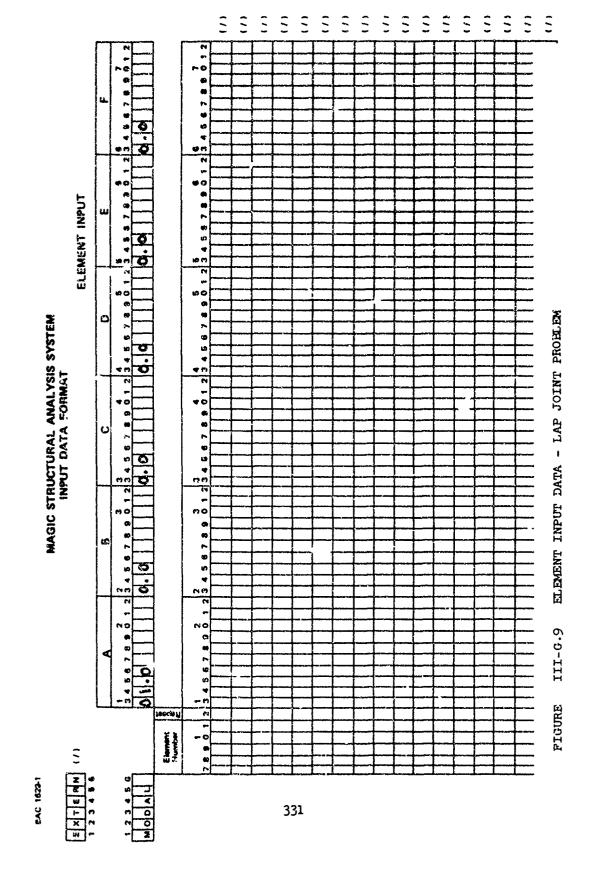
ě

ELEMBET COMPROL BATA

2222222222222222

- LAP JOINT PROBLEM ELEMENT CONTROL DATA III-G.8 FIGURE

330



MAGIC STRUCTURAL ANALYSIS SYSTEM INPUT DATA FORMAT

CHECK OR END CARD



END (/)

FIGURE III-G.10 END CARD - LAP JOINT PROBLEM

TEST8004

TEST MAGIC

STAST RUCT TON SOURCE

TEST8005 TEST8006 * *TEST8001	TEST8008 TEST8009	TESTABLO • • TESTABL	TEST8012	7EST8014	TEST8015	16576016	TESTOOLS	TEST6019	16576620 165760 1	16578022	TEST8023	165 18 324 185 38 02 5	TES TB 0.24	TEST8027	TEST6028	16518029 Tec 78030	TES 18635	7 ES TOG 32	16578633	16516035	TEST80%	765 58 657	755 75 634	1657866	76579641	75578662	165.0000	16574005	TESTR. CO.	16818847		16578656	7857848E	785 78 05 2	145.74654
STATECS AGENOUM MITHCLT PRESCRIBEC CISPLACEMENTS * * * * * * * * * * * * * * * * * * *	STATICS INSTRUCTION SECLENCE			GENERALE ELEMENT TARKES	.M. 18., M.D. TR. , NEL.FIEL, SEL, STEL, ., SC. EM US ERO4.		1) CHET AND (1 x 1) AULE	INT FORPAT FCF	11 • 55 506-17.	II.HULLSC	Olff = il . Still. SC (5,1)	ASSENSE: STIFFESS PATER A DAG REPEAT ASSIDED LOADS		EN .ASSEM.		COUNTRY CARD OF ALL OUR ALIMATE	REDUCE STIFFNESS RETRIN AND FRINT		KOLKAO = KRIA ODEGOIN. (SCOSIN)	PRINT (FORCE DING 0) SAIPE		FORM REDUCED TOTAL LCAE CELLPA	MISTER TO SERVICE ARESTED START OF SEASON OF SEASON	FTELS - PIELD-MILTOLSCALE	TRANSFICKE EXTERNAL LCACS TC 0-1-2 ASSEMBLEC STSSEM	COMPO - TRUMCT, COMOS	TOKE LEINE E'NO CLEEVAN			SOLVE FOR OI SPLACEPEATS	KK . TTEE. GEOFF. TO DAND	٠.	X = 12120 7444 7, >>		CALCULATE REACTIONS ABC INVERSE CHECK
Jun	ບບ	ں ں	υ	ں ر	-	u u	ں د	U		M		ں ں		3: •••	33		υ (. 01		U	, ,	, 11	U	18		14	U	.	ر ۳		17	3 0	ں ر

PIGURE III-5.11 MAGIC ABSTRACTION INSTRUCTION LISTING . LAP JOINT PROBLEM

TEST MAGIC

三十年 一天

******		T WEST WEST	16576050	FES 84 459	75578444	7 ES 7000 8	7 ES 78 06.2	E \$58 531	165 20 000 00 P	76578049	7 ES 5 BOA &	" FS TB CA.	16578068	7.65 TB 66.0	76578970	Testbota	Tes 78072	16578073	16578074	TEST8074	2 ES 7 BO76	TESTEGTY	1681891	TEST#070	SESTWOOD S	Testado.	
	REACTS & KELA . MALL AND	æ	IF (DIFF.MUL.) GO TC 10		ELEREN APPLEED LEARS, ENTERABL LEAGS,	メルカし コブロアの 人を見り 一名 子がまいれ 「子 ハケハ・ド・ ハック・ドルドル かのきょうが		CLEMENTS MAVE I ON 2 DEGREES OF FREEDRY		- W. W.	IN THE S.	INT Z.	PAP KeF VeF Z.	K 2		こうしゅうしょう こうしゅうしゅうしゅ しゅうしゅうしゅ しゅうしゅうしゅ しゅうしゅうしゅうしゅうしゅうしゅうしゅうしゅう しゅうしゅうしゅうしゅうしゅう		IN IC 40 96FR 9 Gof Zo Go PBE TA. Se Fig. 0. F3 95C .T #	IR II 4 FR . Q.F.Z. C. FBE IA. Q.F.I. O.F3 . S.C.	×	of a last looper of the control of t		MENERATE STREETS AND FORCES	ļ			
u			,	Ų (، ر	، ب	، ر	J (ر					•	ي د	۽ ر) د	⊝			•	, ر	J (؛ ن	8		334
	**	20	21						*	77	9 ·	† (£2	0			ŧ		• (> (3					¥	

FIGURE III-6.11 CONCLUDED

MODIFIED GLADRILATEFOR THIN SPELL EL: KERT IDEN. NO.33 FOUR ELEMENT PLATE SLEJECTEC TC A SPEAR LOAD SISATURE STRATE ASPECT RATEC 16,C

Main and

REVISIONS OF PATERIAL TAPE

4STEFISK (*) PRECEGOING MATGRIAL IDENTIFICATION INDICATES THAT INPUT ERFOR RETURNS MILL NOT RESIG. I PY TERPIPATION OF BEECHTION

INPUT CODE HATEPINE MUNBER

MATERIAL PROPERTIES

335

T FURERATURE

WOLKG'S PCDLIS

DIFFECTIONS

2.2 0.3000005.0 C. 3COCCOE OR 0.300000E CP

50-30000£9*0 77

\$0-302059 %

XX 0•#30000E-C5

TENPERATURE

DI RECTICAS

M. EXP.CCEF.

NY 0.135385E 06

V2 0.115389E C4

DIRECTIONS

25 3000000 es

0.36000CE CC

AY 0.300006E 40

RIGIDITY MJOUR !

DIRECTIONS

POLESON'S RATIOS

TITLE AND MATERIAL DATA OUTPUT - LAP JOINT PROBLEM FIGURE 11X-0.12

23 FEF. PCINTS

ND. DIRECTIONS # 3 NC. DEGFEES OF FFEEDOF # 1

GRIDFCINT CATA
(IN RECTANGULAR CCORCINATES)

RESSIRES	•	æ	_	~	<i>p</i> 4	•	•	6	•	6	_	•	C.	6	•	•	0		#	ø	Ð	9	ø	•	6	ø	•	0	ο,	0
	9	9	å	•	9	0.0	Ö	•	ö	٠, •	*	, 0	40	ö	9	9	5	9	9	ő	7. 6	; 0	0	ò	9	ċ	ô	0	0.0	ô
TEMPERATURES	0.0	0.0	0.0	0.0	0.0	000	0.0	0.0	0.0	0,0	9.0	0.0	0,0	0.0	0.0	0,0	0.0	0.0	0.0	0.0	0.0	9.0	0.0	0.0	0.0	0.0	0,0	0.0	0	0,0
7																														
																												_		
	0			0.0			0.0			0.0			0.0			0.0			0.0			0.0			0.0			0.0		
				93						00			:						S			5			Ç			CI		
-	0;0			C. 625000CE Q			9			C. 625 CCCCCE			C. 12500000E			9			C. 625C00CKE (C. 125 COOCCE (0. 625000CE			C. 12500000E		
	02			02			02			02			02			03			20			02								
×																														
	0.3000000E			0.3000000C			0.2000000E			0.20000000			0.20000000E			0. 10000000E			0. 10000000E	·		0. 1000000E								
	0°30			0.30	•		0.20				! •		0.20			0.10			0.10			0.10			0.0			0.0		
								3	33	5																				
POINT	end			M	;		•			•			0	1		4			91	<u>.</u>		80			14 N	ı		23		

Š
Ħ
Ŧ
NFC FH AT
-
1
₽
CCAUIT
Ţ.
~
2
3
ž
て
ě

	MO. OF TWOS		u a a a a a a a a a a a a a
	NO. OF UNES	ണെട്ടി സെ എ ഇന്റെ ഫെ സെ ന ബ് ബ് ബ	1 00 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
	ė.	55000000	0000000000000
	DEGREES OF FREEDOR	00000000	0000000000000
;	EES CF	00000000	9 9 9 9 9 9 9 9 9 9 9
	DECP	0 0 0 0 0 0 0 0 0	00000000000000
		U m m U m Q m m m	ल्ट चे म्हें न चे मा मा मा मा मा मा मा बा बा
		लेल लेल लेल लेल	ल लेल ज ज लाल ल ल ल ल ल ७ क क्
	MODES	まてきぬ ちもて 目 ち	ちょうきょうきょう できること ここごご こうきょう しょうきゅう ちゅうりょうしゅう じょうちゅう しょうちゅう しょうしゅう

TETAL NC. ELEMENTS =

C. 1000E CI G. 0.0 EEFERTIES	C.C. C.O.C.C.C.C.C.C.C.C.C.C.C.C.C.C.C.C	G.O G.O G.O C.O C.O MATRICES REPEATED G.O G.O G.O	
TA GR 10 9	9 9 9 0 7	# 00 00	
PRINT AC	PRE-STRESS = 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	PARE-STREES = 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	
MAT-MO. CJDE TEMP. 1 99398 0 9.0 99398 0 0.0	0 3 0	3	
2 38 491	3 38 99396	80E00 #8 +	

FIGURE III-6.14 BOUNDARY CONDITIONS AND FINITE ELEMENT DESCRIPTION - LAP JOINT PROFIEM

5

LOAD 80. 2

-			
14 - 0.1000000E 0	0.0	0.0	0,0
ELEPENT LCAD SCALAR =	0.0	0.0	0.0
ELEPEAT	0.0	0.0	0.0
MDDES 3	ð	ယ ခံ	9
LOADED	0.0	9.0	6 × 6
b	~	6	3
WHEEK OF LOADED	P. 14 78	30,111,0	0. E46. W
	-	~	M

TRANSFERMED EXTERNAL AGSEMBLED LOAD COLURN

9 9 9

ed to depen	0.0 0.0 0.0 0.0	0.0 0.0 0.0 0.0	0.0	9.9	0.0	0.0 0.0	0.0	0°0 6°0	0.0 0.0	0*0 0*0	0.0 0.0	0°0 9°0 9°0	9*9 0*9	0°0 0°0 0°0 0°0	⊕*C ⊕*O 0*⊕	¢°0 0°0 0°0	0.0 0.0	0.0	0°0 0°0 0°0 0°0	0.0	0°0 0°0		
	8. 16669198E. 92	6.46659410E GZ	6-13-6999E GZ	• •	•	6.3	2.0	•	•	4.5	33	8	0.9	0.0	9	0.0	0.0	•	•	0.0	n • e	•	

9

3

Tozenc fee structure . 0.0

•

6.0

3

0.0

4

Selected the contract of the selected selected and the selected se

		88	!	8 8		8	3	8	8	8	\$	5	8		5	\$	8	5	*	\$ 8	g	5	-	¥ 1	B	\$	86	;
		G. 1373 63E		0, 1 630 63 E		-6.4489235	A. 256680E	C. 1 01 1 50E	- 6. 628 #33E	0. 345176E	-0.236 01 5E	-6-23te94F	-6. 60562 SE		-0.421242E	4. 114750E	0. 349236E	-0. 5523 75E	3. CH 46.65E	-6.327929E	0.477.05 BE	.0. 236095E	0.45 34 035	-0.066290E	3	-C. 236. 75E	0, 2090ADE 0, 452374E	:
	FOACE	w 5		٠ <u>ي</u>		*5	O ==	•	9	*	•	80			•	30	•	01	1671		7.0	•	30	* ¢	,	×	25	,
m	_	ö ö	•	5 0		6	6	50	œ Ø	ě	6	ë	*		ë	3	Ş	6	4	٠ <u>٠</u>	9	*	0	۵°	3	5	96	,
36 84		0.353126E		-0-82888X		-0.42124%	-0.23407#	9-18765%	0.47709Æ	6-191190E	0.43646%	-0-132234	0.19.7±K		0-10476#	-0.13223K	-0.53113E	-0.238046	6.477esæ	0.41571W	6.23809.X	-0.92188X	-0.327729	-0-18675CE		-0.23805%	-0.3200005	1
\$ 17 E	FOXCE	◆ •		• •		•	•	4	•	*	*	•	•		•	•	*	•	•		23	•	6	- K	Ç	•	o £	,
		0 0		36			35	6	55	Ş	58	Ļ				21	3	88	93		3	05		3 5			e e	
		0.421242E	-0.416665	0.9523746	0.238094	0.9381076	-0.237478 -0.237478	-0.4212456	-0.531133E	-0.4669136	0.345234E	-0-9523776	0. 700000E	0.236095	0.952376E	-0.328060 E 0.421243 E	-0.30£750£	0.2625996	-6.2300946	36666	-0-821883E	0.290000	-0-452375E	-0-330000E	4 A A A A A A A A A A A A A A A A A A A	0.466476	-0.417188E] ! !
	FCRCE	n e	2	* *	2	m	- 2	n	-2	m	# 📆	M	•	2	•	= 3	#)	-2	•	- <u>f</u>	1 2 3 3	m	• ;	2 1	t	m	- 2	
				5 5		-	66	6	90	6	68	07		8		88	6	04			6	8	-	5 8			67	
0.0		-C.163964E	0.477058E	0.329302E -0.606250E	-C. 821893E	C.646000E	0,952376E C.234092E	-0.163764E	0,104762E 6,355126E	-0.531136E	-0.421242E	-0-88£750E	-0.966297E	-C.132234E	-C.606250E	3,102124E 0,104761E	0. \$32376E	-C. 320C00E C. 531 133 E	-0. 821 683/E	-0-13223%	0.355126E	G. 163003E	C. 114750E	-C-327529E	76 86 1 98 3 5 A	C. 150000 E	-C. 952375E -C.320000E	1
ŏ	FCACE	~ ~	71	v ~	15	~	- 2	~	۲2	~	7	~	•	12	~	7 77	~	۲2	~	~ ^	2	7	~	7 7	Ç	8	128	:
OFF		5 5	5	2 8	ũ	6	S S	0	35	g	33	8	S	C	CB	35	6	38	•	38	165	5	3		3;	5	t; o	
נהו		0.107897E	G. 236052E	- 0° 1037646 - 0. 6367 506	0. 1600006	0.4212426	- 0.952377E 0.468476E	0.576246	- 0. 132234E - 0. 236059E	0.1373636	- 0.236054E	0°.1047£2E	0.102124	0.452376	-0.132234E	- 0. 5642 57E - 0. 5923 75E	0.235054E	0. 7050 CGE 0. 4171 88E	0.3551.26E	6. 104762E	0.238054E	- 0. £2188%	-0.405625	6. Ageograph . 6	0.23f0f4E	0.2380526	0.592376E	,
	FORCE	, •	77		=	-	•=	~	9 77	***	• =	~	•	11	-	• ::	-4	* #		• =	28:	••	•	= 8	32	•	^ :d	
	_	~1	4	N		M		*		80		•	,		^		•		•			01				11		
												3	39															
		Otse		4510		4310		9510		0152		SIS	•		4519		0159		4510			9810				9510		

FIGURE III-6.15 STIFFNESS MATRIX - LAP JOINT PROBLEM

							~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~	23 / 121 / 62					7 4 GE 7	
			2010	* #	0.0	0			SKZE	E 38 BY	•			
	8	FORCE		u.	FCRCE		FCRCE	4	FORCE	u u	u.	FORCE		
4510	다 #1	22	- 0.3687506	28	23	-C.238096E 0	%	0° 280000 E	02 25	0.466476	6	*	0.232092E	5
0159	12	~ 4	0.47705#E	8 8	~ ~		003	0.23/9926	4 07		0 0	w 0	-0.137367E	Ŕ S
		127 %	- 0-320000E 0-57824E - 0-132234E 0-710252E	7585	12 17 28		50 - 50 50 - 50 50 - 50 50 - 50 50 - 50 50 - 50 50 - 50 50 50 - 50 50 50 - 50 50 50 - 50 50 50 - 50 50 50 - 50 50 50 - 50 50 50 - 50 50 50 - 50 50 50 - 50 50 50 - 50 50 50 - 50 50 50 - 50 50 50 - 50 50 50 50 50 50 50 50 50 50 50 50 50 5	-0.10.1596 -0.13.2345 0.4770546 0.2390926	HHNN	-0.1639447 0.2095246 -0.8218836 0.4770585		3202		3223
9510	ñ	- 4m 4m 4m	0.239099E 0.239099E 0.537361E 0.239094E 0.30000E 8.134982E	5588585	~ - 25 25	0.238094E 0 0.421243E 0 -6.101190E 0 0.16423E 0 -6.39463E 0 0.199719E 0	2000 00 00 00 00 00 00 00 00 00 00 00 00	-0.234479E 0.943233E 0.913527E -0.236094E 0.236093E	009 6 009 14 009 14 009 14 14 007 14 14 14 14 14 14 14 14 14 14 14 14 14	0.137361E 0.15000G 0.531133E -0.10000G -0.234679E	00000			238388
340 65	±	27.23	-0.163964E -0.531136E -0.821663E 0.234094E	2859	55	C.531133E O 6.236096E U.	1 A A	0.329302E -0.952377E 0.163003E	07 21 07 21 09 29	0.640000E -0.606250E 0.16000E	777	30 75	-0.163964E 0.452376E -0.621993E	\$58
9510	\$	2222	0.421242E -0.461613E -0.23497E	3333	119	-6.468613E 09 -C.952377E 07 -6.234479E 09	**************************************	0.640000 E -0.289938 E 0.286060 E	02 15 03 21 02 29	0.938107E 0.952376E 0.468476E	6 6 5	36 36	-0.421245E	28 3
1 4510	*	27.22	0.578249E 6.101150E 0.47705@	8 3 8 8	212	-0.137341E 0 -6.13224E 6 0.416669E 0	\$ 8 8 £ £ £ £	-0.163964E -0.238094E -0.821883E	09 15 07 21 08 29	-0.42124% 0.1047426 -0.23809%	353	2 2 2 E	0.107897E -0.531133E 0.355120E	823
1 4510	14	3222	0.137343E 0.305176E 0.416465E 0.458574E	8538	213	0.164238E 09 -C.238094E 67 0.334982E 09	**************************************	-0.531136E -0.394856E -0.238095E	67 15 06 21 07 29	-0.4688136 -0.4212426 -0.234479	565	322	0.184190E 0.345230E -0.137367E	888
4510	2	28 28	0.104762E 0.102124E 0.432376E	355	70 70 70 70 70	-0.888750E 0: -0.966297E 0: -0.132234E 0	02 08 08 08 08 08 08	-0.952377E 0.70000E 0.236095E	07 12 03 23 07	-0.132234E 0.104763E	8 8	24	-0.234094E	e a
4 8 10	*	0 4 0 4 2 4 0 4	-0.132234E -0.886750E 0.204248E 0.114750E	288	2040	-0.606250E 0 -C.952377E 0 -C.320000E 0 -C.952375E 0	01 00 00 00 00 00 00 00 00 00 00 00 00 0	0.952376E -0.132234E -0.966297E 0.209523E	07 12 08 17 08 22 08 27	0.209524E -0.238054E 0.70000CE	2 000	医直角型区	-0.100000E -0.566257E -0.132335 -0.605023E	388

CONTINUED FIGURE III-G.16

ı			736 00 2557 01 736 37 256 53	35E 96		45E G7	195E 97 62E 99	79E 09	3 4 E 0 E 0 E 0 E 0 E 0 E 0 E 0 E 0 E 0 E	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	836 08 756 07
! !			0. 640475E 0. 7004001 -0. 652375E -0. 692375E	0.104762E -0.132239E	-0. 531, 335 0. 2425996 0. 5311336	6.416465E -0.163965E	-0.236095E 0.329302E	-0.234479E 0.144000E	0.300000E -0.132234E 0.578248E -0.327929E	-0,2360°6E 0,2360°6E 0,53132E -0,537626E	-0. 6216836 -0. 9523756
	FORCE		4 4 7 7 6 6 6 6	976	2 2 2 2	24	13	24	~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~	45464	22
e;	•		0000	500		9 0 2 0	" v	60	* C C & C C	~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~	
36 67			-0.400000E -0.35485CE -0.2380°CE 0.43237CE	0.95237@ -0.3200@@ 0.104761F	-0.300750E -0.328060E 0.417160E	0.47705EE	-0.82188 X	-6.23009E -0.42124Æ	0.7102536 0.4164636 -0.236696 -0.1011906 0.1847636	0.22000E -0.22000E -0.42000E	0.26000E 0.114750E
S 12 E	FORCE		12 17 23 28	20 C	S 7.5	23	12	23 62	272727		15
		6	3835	586		90	200	888	588888		\$ 5
		0.238045E	-0.238750E -0.238094E -0.280676E 0.660471E	-0.60\$250E 0.102124E -0.452375E	0.952376E -0.250676E -0.952375E	-6.236096E -0.236096E -0.137348E	0.280000E -0.952375E 0.531132E	0.466476E 0.417188E -0.468613E	0.230092 E 0.477098 E -0.32235 E 0.323570 E 0.37000 E		163003
	FCFCE	æ	= 285	277	194	38 5	= 8B	ar	= 3 2 4 5 4	anaaa:	18
		8	5885	2 2 2	0 7 0 0 0 0	0 0 0	388	0 2 0 7	030000		07
0.0		-0°132234E	C. \$52.376E -C. 289938E C. 565198E -C. 1 00000E -0.354 849E	0.238094E -C.966297E 0.11475GE	-0.354651 E 0.700000E -6.354853E	-0. 821 863 E -0. 132235 E C. 57824 RE	0.143003E C.114750E -0.163944E	C. 140000E -C. 952375E G. 421262E	-0.821983E -0.233096E -0.100090E 0.421242E 0.115650E	0.238094E 0.416685E -0.238096E -0.328473 0.328473E	C.238093E -0.605625E
o i	FORCE	9	2 4 4 5 6 5 6 5 6 5 6 5 6 5 6 5 6 5 6 5 6	N - 2	212	252	10 14 26	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2		0 4 3 4 3 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6	2 2 3
#		5	55385	9 7 6	5 8 5 8	386	282	555	22222	588888	85
CUT		0. 5523 76E	0.239094E - 0.952377E - 0.320040E 0.417188E 0.238055E	- 0. 132234E - 0.421242E - 0.236056E	0.238094E 0.34523E -0.238094E 0.345233E	0.35!!126E 0.104762E -0.421245E	-0.821983E -0.605425E 6.144000E	0.2380\$2E 0.952374E 0.9381C0E	0.477056E -0.821995E 0.299523E -0.1839964E -0.328996E -0.132294E	- 0.415645E - 0.234474E - 0.49641E - 0.19669E - 0.35485E	- 0, 238095E
	FORCE	2	4 4 5 8 8	325	2 7 2 2 2	o 25	2 to 2 to 3	* * *	* # # # # # # # # # # # # # # # # # # #	* # 5 W 5 W	22 17
		2	2	2	22	S	2	*	92	2	2
						34	1				
		9510	9830	9510	9 510	0130	9810	015F	• SIG	e 82 00	OISP

FIGURE III-G.16 CONTINUED

		85	5888	3228	3888	85	58	35	88	58	58	ಕ
•		32 9E	200 E	0.3558.24E 0.531.33E 0.21.71.3E 0.331.33E	0.137361E 0.349233E 0.198600E 0.345236E	346	25E	762E	336	65E 153E	386	
		-0. 327929E 0. 952376E	-0.238055E 0.417188E -0.326060E -0.36756E	0-3551.246 0-5311.336 0-21571.36 0-5311.336	0-137361E 0-345233E 6-198600E 0-365236E	-0.421242E	- 0.2380% E -0.254125E	0-104762E -0-236896E	-0.931133E 0.282599E	0. 41 646 3E 0. 354853E	-6.238055E 0.417198E	0.137361E
		ਰੂ ਰ	9 9 9 9	9094	င် <i>မို</i> ခွဲ		ø o	उ द	ợ đ	o e	9 5	Ġ
	FORCE	9 60	9 7 7 8 9 8 9 8 9 9 9 9 9 9 9 9 9 9 9 9	3 4 7 6 6	4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4	9 %	30	2 %	9 8	9 8	8 M	36
200	T.	ñ =	50	C 0 0 0	2000	55	M 0 0 0	6 0	7 7	5 6	2 0	S
*		2 2 2 2	# 25 C	2 2 8 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	# # # # # 2 2 2 2	9 TH	2 2	25 B	20 00 20 00	2 2	**	2
38		0.20400CE -0.604259E	0.468476E 0.492379E 0.187628E 0.992376E	0.238092E 0.104761E 0.3260GE 0.104762E	-0.234474 0.421243E -0.431243E	0.952377E 0.786964E	0.20992 <i>6</i> 0.34523 <i>6</i>	0.152374E 0.32000Œ	-0.368756E -0.32600E	-0.234479E	9.46867 6 -0.05237 2	-0.23447E
		0 6	000	0000	0 0 5 0	ě	o a	ð 4	, ,	9 6	Ø 6	ő
S 12 E	FORCE	2 %	222	11 N N M	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8	\$ *	38	2 %	8 4	2 %	*
		255	2000		55668	88	88	3 &	588	588	8 6 6 6 6 6	6
		0.656663E -0.952377E 0.236094E	0.160000 E -0.299125 E 0.200000 E -0.299938 E	0.2386956 0.2386956 0.3279296 0.1373418	0.238094E -0.35484FE -0.35080E -0.354850E	-0.888790E	-0.9523775 -0.280676E	-0.4962506 8.362124E	0.992376E -0.280676E 0.345233E	-0.236096E 0.345236E 0.164238E	0-160000E -0-299125E -0-464813E	0.2380946
	44	J Y J	94944	γογγο	9444	77	44	7"	90	9 00	9 99	G
	FCECE	おおお	1 RRRM	1 名称用果	法保险股票	2 %	# #	8 %	222	用品牌	8 22	R
		000	\$5555		2222	386	6 6	466	8 56	800	868	6
v		-0.2%9000E -0.096790E C,160000E	-0.234479E 0.952376E -0.937424E -0.952377E	-C.416669E -0.132234E d.130006E -0.132234E	0.134962E C.238095E 0.328475E -C.238094E -G.234479E	0.421242E 0.162124E 0.238045E	0,345237E 0,282599£	0.2380045 -0.2360457 -0.423457	~ K, 39%-851E 0, 700000E 0, 417168E	C. 938573E -C. 421262E -C. 468614E	-0.234479E C.952376E C.938108E	0.134302E
0.0	FUNCE	2 2 2 5	# 57.25 # 57.25	22222	Mana m	222	28	n na	22.5	2 22	# 35°	72
4		282	5 2022		33888	355	5 3 8	255	583	888	888	23
Cut		- 0.327929E - 0.356060E - 0.238096E	0.238092E - 0.234479E - 0.320000E - 0.937624E - 0.234479E	0.477058E -0.137367E 0.115656E -0.19000E 0.416669E	- 2- 4164 £9E 0.998574E 0.198000E 0.416351E 0.134942E	0.104762E -0.239094E 0.552376E	0,5311326 -0,394850E -0,394850E	· 0.132234E · 0.421242E - 0.932379E	0.239094E 0.345234E .0.394853E	- 0.137361E 0.134962E 0.305177E	0.238042E - 0.234479E - 0.468814E	- 0, 4166692
	FORCE	2 22	2 2 2 2 2 2	25222	22222	2 22	2 2 2	* * *	* ##	222	2 22	2
		2	2	8	II I	32	8	*	38	36	FE .	30
					342							
		4810	9510	e 210	850	4510	4386	4550	2. 19	9810	e an	85.00

CONTINUED FIGURE III-G.16

Regulated to the distribution of the second

		0.345233E 00
	FORCE	8
		6
36 67		0.421243E 07 35 Q
321S	FORCE	*
	_	33 -0.354848E 06 34 36 0.305175E 09
	FUNCE	22
0		0,234095E 07 33 -0,468813E 09 38
CUTCFF = 0.	FURCE	3 7
CFF.	٠.	8 S
CUT		0.596574E 0.164238E
	PORCE	36
	_	*

9310

FIGURE III-6.16 CONCLUDED

30	Ħ Ħ	F.	F2	int int	Š	
~	0.1665955WE 02	0.0	0.0	0.0	ວິວ	0
~	0.6665998EE 02	0.4	000	0.0	0°3	6
m	0.16659958 02	ల	0.0	•	6.0	6
•	0.0	0	0.0	3 • 6	o J	9
5	0.0	0 %	0.0	0.0	6.0	6
•	0.0	೦	0,0	0.0	93	જ હ
^	0.0	° 3	0.0	0.0	27	8
•	0 3	6.0	0.0	0 *0	0 3	ç
•	0.0	0 %	0.•	0.0	£.0	9
2	0.0	ç	0.0	0.0	9	9
3	0.0	0.0	0.0	٠. •	٥.0	3
22	9°C	0 8	0.0	0.0	6.0	9
13	0	0.0	0.0	0.0	63	0 %
*	0.0	0.0	•	0.0	Š	ර
57	0.0	0.0	\$*0	0.0	05	9
16	0.0	٥.	0.0	0.0	0.3	60
å	ల	7 3	0.0	0.0	6.0	9
	0.3	0.0	90	0.0	0 5	9
82	0.0	93	0.0	0.0	05	0
50	9.	O * O	0.0	9.0	0.0	o ರ
21	0.0	0.0	₽•0	0.0	0,0	3
22	0.0	Ф - Ф	0.0	•••	Š	ð
23	0.0	9.0	0 •	0.0	0.3	60

FIGURE III-G.17 GPRINT OF MATRIX LOADS - LAP JOINT PROBLEM

DISFIACEPENT PARRIX FOR LOAD CONDITION

138 : 1

ROM	Ð	٠.	39	THETAX	THE TA 1	THET AE
~	6.13901084E- C3	0.0	0.0	0.0	C° O	0.0
~	0.134876092-03	- D-47325757E- V	0.0	0.0	6.0	0 8
e	0.13477041E- 03	-0.544463535-04	0.6	0.0	° -	9
*	9. 10810344E- C3	0.4	5.0	0*0	9 "3	0 0
sn.	0, 10821772E- C3	-0.10245158E-05	0.0	0•0	ಭ ್ರ	0 3
*	0.819774425- 24	៰	0.0	0.0	0 "3	0 3
1	0.814621765-04	~ C. 38511168E-06	0.0	0.0	c	0 4
•	0. 8129 09 5 TE- 64	-0. 77££7436E-06	0.0	0.0	0 3	9 3
•	0, 665243636-64	-0.10358408E-05	0.0	0	83	° d
2 345	0, 7954 38746- 04	-0.17 £7 £1 £1 £-05	0.0	0.0	0.3	0.0
=	0. 6746 42 £5E- GA	0.0	0.1	0.0	20	9 3
12	0.67667250E-04	-C. 44860721E-06	0.0	D*0		0
£	0. 67976827E- 94	- C. 92 653559E=06	0.0	0°0	Ç.Q	0 ರೆ
*	0, 354887526-04	0 %	0.0	0.0	°3	ಂಕ
S1	0.54964509-24	-C. 30050543E~06	0.0	0,0	ຶ່ງ	9 8
*	0. 5425 68532~ 04	-0,61322883E-06	O	0*0	9 3	• 6
11	0. 5348 TT 62E- 04	-C. 1003 163 96-05	0.0	0*3	ទំ	9
8 2	0.527616546-04	-C.14C3C793E-05	್ ಂ	0*0	0 %	o d
61	0,2721902X-04	-C. 54516899E-05	0.0	0.0	8*J.	0.5
Д	0. 26472917E-06	-0.1048855E-04	940	0.0	č	9
12	0.0	-0.12465570E-04	*** 0	Ø.0	ទឹ	9
22	0.0	-0.12547585E-04	0.0	0•0	S	0 6
Ø	0.0	-C-13410909E-04	0.0	0.0	0*3	0.0
FIGURE	111-6.18	DISPLACEMENT MATRIX - LAP	JOINT PROBLEM			

~

FIGURE III-G.19 REACTION MATRIX - LAP JOINT PROBLEM

QUADRILATERAL (STRESS FCIAT FLVE EQUALS ELEMENT STRESSES EVALUATED AT THE CENTROLDS AATIO H 0 H w ≖ F 0 R

	•	SKEAR PCRAN	000 00	SHEAR KCRPALIGY)	မာ ဓ ၁၁ဝ မော်ဆိုတီတီဝီ	SHE BB FCRPAL (CV) 0.0 0.0	\ 0 d d
	2 8 7	NOR PAL (GX)	0000	NOR PAL (QX)	မမာ့ စာမာ့ င ပေတီတီတီ	MOR MAL 60 XI 0 - 0 0 - 0 0 - 0	7 0 0 0
BLENSNT GRID POINTS	49 60 FA	PLEKURM, MOMENYS Morma, (MY) Torg DE(MXY)		F. EXURAL MONBNTS MCRMAL(MY) TORQUE(MXY)	9 0 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9	P. EXURAL NORBNTS NORMAL (4) TORQUE(HXY) G-0 G-0 G-0 G-0	
ELEPEAT TY FE	9	NERPAL (POX)	60995	NOFPAL (POX)	20000	MORPAL (PK)	0.00
ELEPEAT ALPBEA		RESLLTANTS SHEDR (NXV)	1 0-173172E 03 1 0-164301E 03 2 0-163610E 03 1 0-196817E 03	reslitarte Shedriany	6 0 0 0 0 6 0 0 0 0	RESULTANTS SMEARCANT 6-173172E 6-165301E 6-138817E	
LOAD CONDITION NUMBER		GLEMENT STRESSES MEMBRANE STRESS NORFAL(NX) NORFAL(NY)	0.155003E 03 0.405542E 01 0.15584EE 03 0.22317C 01 0.15522E 03 0.12794EE 02 0.159217E 03 0.578467E 01	STRESSE HENDRA NX)	မစ္စစ္စ ဒီဓီဓီဝီ ဝီ	NT STRESSES REMBANE STRESS MORNAL(MY) -16500E C3 C.405542E C1 -15506E C3 C.405542E C1 -157346E G3 C.4794E C2 -157346E G3 C.4794E C1	63 - 0.14122E
LOAD		5 5	1 0.16500% 3 0.156646 3 0.156648 4 0.1569226 5 0.1592276	STRESS HORMAL(MET ELEMENT STRESSES STRESS PORMY MORMAL(WX) 1 0.165003E 03 2 0.35646EE 03 3 0.564545EE 03	#12657.0 347

FIGURE III-6.20 STRESS OUTFUT, ELEMENT NO. 1 - LAP JOINT PROBLEM

QUADRILATERAL (STRESS FCIAT FIVE ECUALS ELEWENT STRESSES EVALUATED AT THE CENTROID) RATIO HIGH ASPECT FOR ARE

	ent (m)	SHEA	6 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	SHEAR	######################################	SHE AN D.C PAL (97) D.C D.C D.C D.C D.C D.C D.C D.C D.C D.C D.C
	7 12 19			8		MON HAL CO 20
BLENENT CRID POINTS	8 16 24	F. BURAL MORBATS HORMAL(NY) TOBOUFFRENYS		PLEXIJEAL MOMBETS Monage (MY) Theore MY		FLEKURAL HOMENTS NORMALINY) TORQUE(MXY) 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
ELEPENT TYPE	*	HORPAL(MK)	00000	PC#FALIFE) H	9 9 9 9 9 9	# C C C C C C C C C C C C C C C C C C C
ELEPERT PLPRES	~	S RESLITANTS Y) SHEDERAY	01 G,93594E 02 02 G,76071E 02 01 G,431229E 02 01 0,564712E 02 01 C,8950/1E 02	HESLITANTS	ပစ္စစ္ ပစ္စစ္ခဲ့	C C C C C C C C C C C C C C C C C C C
LOAD CONDITION MUSBER	~	APPAR BIT BLEMENT STRESSES STRESS HENGRANE STRESS POINT NORMALINN NORMALINY	1 0.917199E 02 - C.990356E 2 0.76289ZE 02 - C.136744E 3 0.776077E 02 - C.732472E 4 0.612771E 02 - C.967964E 5 0.509624E 02 0.285979E	ENT APPLIED STRESSES IS MEMBRANE STRESS MORMAL(WX) NORMAL(NY)		S MON T STRESSES MON MAL (W. N. MON MOL (W. O. 917195E G2 - C. 99 G35 EE O. 776 G7F G2 - G. 13 674 EE O. 776 G7F G2 - G. 96 79 24 72 EE O. 73 24 72 EE O. 75 24 72 EE O. 75 24 72 EE O. 75 24 72 EE O. 75 24 72 EE O. 75 24 72 EE O. 75 24 72 EE O. 75 24 72 EE O. 75 24 72 EE O. 75 24 72 EE O. 75 24 72 EE O. 75 24 72 EE O. 75 24 72 EE O. 75 24 72 EE
		STRES POINT	- -	E TRENT STRESS POINT	™ (7 W 4 W	200 200 200 200 200 200 200 200 200 200

FIGURE III-5.21 STRESS OUTPUT, ELEMENT NO. 2 - LAP JOINT PROBLEM

ISTRESS FCIAT FIVE EQUALS ELEMENT STRESSES EVALUATED AT THE CENTROIDS

		Shear Acrpal (GY)	ဗာဇာ၈ ဝ ပောင်းတီပော်	SME AR RERPAL (GY)	ಅ೨ ೦೦೦ ವಿರಿತಿತಿತಿ	Swe dr Acrpa L (Gy)	၀၀၄ ၈ ၈ ဝင်္ခ ဝင်္ခ	
	12							
	13	nor par (gx)		AL 60		AL 10		
	13	NON N	00000	NOR HAL (0 X)	၀၈၀ ၀ ၀ ဝင်ဝန်ဝန်	NOR PAL (0.2)	သည် စစ္တေ သည် စစ်ချိန်နှ	
	₩.							
ELEMENT GRID POINTS	*	MOM BUTS HV) TORQ WE(H XV)		Mokeus IV) Torque(may)		B Tore We (M XY)		
91 95	97	15 1782	00000	TS TORO	00000	78 708	00449	
ENT	20	& 5~		8		MONDAYS		
E.E.	•			=		3		
_		FLEKURAL MO MORGAL(HV)	00000 00000	P. DEURAL MO HORRAL(NY)	Q Q Q Q	P. Skural MS	99999	PROBLEC
ELEPENT TYPE	**	NCPPAL (NX)		HORPALCHES		HOPPAL (PR.)		. LAP JOINT PROMUNK
3		ž	00665	*	00000	*		n n
LEPEAT PLPEES	m	re sul tarts She de (rxy)	C. 621751E G2 0.507861E 02 C. 854258E 92 0.631621E 92	ak sletak 15 She ar erty		resultarts Shear (nxv)	0.621751E 02 0.557861E 02 0.65786E 02 0.631621E 02 0.926678E 62	STRESS OUTPUT, ELEMENT NG.
w		3 2 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3	55535	SS		2 £	55535	00 E
N NUMBER		STRE SSES MEMBRANE STAESS 4X) NORMAL(NY)	- C. 134233E - C. 4940854E - C. 45465E - C. 18594E	TRESSES MEMBRANE STRESS X) NORMAL (NV)	ဇေဝဝဝ ပိပိပိပိ	SES MEMBRANE STRESS Ky Mermal (NY)	- 0.1362386 - 0.490646 - 0.9256646 - 0.144496 9.1899366	
1110	~	STRE	2222	E SE SE SE SE SE SE SE SE SE SE SE SE SE		25.55 25.55	22238	III-G.22
LOAD CONDITION NUMBER		B. EMENT	0.6197196 0.6055716 0.9826216 0.7547026 0.8167596	APPLIED STRESSES NEMBRAN NJRNAL(NX)	00000	rendet stresses 35 mermet	0.819719E 0.605571E 0.962661E 0.794760E	FIGURE II
		STAESS FORT	~ N # 4 W	E. CHENT A STACKS POINT	⊶ « » ◆ »	net at enc Stress Point	~ NA43	34 ₉

(STRESS SCIAT FIVE EQUALS ELEMENT STRESSES EVALUATED AT THE CENTROLOT RATEO

		A Acres: (QV)		P ACRMAL(QV)		r Reral (6V)	
	£.	## B#\$	ୟ କ ପ ଓ କ	SVE AP	၈၀၁၈၀ ပ်စ်ပ်စ်စ်	SHEAR	ပ်ရီစီနှံရီ ပြောရာဝခ
	22 1	r cox		1.623		r (om	
	5 2	NCR PAL 69 X)	00000 00000	HOR PAL (92)	00000	HOR PAL (0 X)	0 0 0 0 0
•	11	?		Ē		\$	
element gred points	7.1	S Tore liec may)		S Torg ure m XV)		S Torg ue(H XY }	
3	23	KTS TORG	00000	17.8 1389	00000	st.	00000
EMENT	2	MCXENTS HYB TO		HOHERTS IT (YN		MONENTS IT	
a	4.1	FLEKURAL MG MDRHAL(NY)		F. SKURAL MO NORRALENY D	***	PLEKURAL MO NDRHAL(NV)	
		۾ 12 ج	99999 9999	a a	66466	٣ 2 ع	0000 0
ELEPENT TYPE	38	(XX)		(X		(A	
LEPENT		RGFPAL(MX)		Hoffal (PK)	00000	NCFPEL (PR.)	00000
~				-	ં ન ન ન	_	
PEEF		S (BXV)	56 6 03 76 6 03 76 6 03 77 6 03	S (NXY)		S FAX T	766 766 766 766 766 766 766 766 766 766
ELEPEAT PLPBER	*	resultaris Shepr (rxy)	0.173666E 8.17278E 8.172626E 8.17767E	RESLLTARTS SHEBR (NXV)	00000	resultarts Shear (rxv)	G. 173666 9.272278E G. 172626 0.277957E 0.277957E
FLEPE		RE SU		E S	ဝိ ဖ်စ်စ် စ်	32	
		STRESS Mal (NY)	22822 32822	STRESS MAL (NY)		STRESS PR.L (NV)	25556 XXXXX
#6 ER			0.125452E 0.42504E 0.445972E 0.28076E 0.17865	E STA	60000	ž	0.125452E 0.92964E 0.44597E 6.20076E
N.		SSE3	ပ် ဖွဲ့ ခွဲ ခွဲ	TRESSES HENDRANE XV	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	SES PENGRAME X9	હે હે હે હે
01710	-	STATE OF THE PARTY	20000 20000	STRES PERM 4X3		SSES REM HENN	86888
COAD CONDITION HUMBER		B. CA. BUT. STATE SSES. MEMBRANE NORMALITAK)	0.165469E 0.159994E 0.160728E 0.164694E	APPL 1ED STRESSES MEMBRAN MORMAL (NX)		NT STRESSES HEM HORMAL (NX)	0.1654656 0.1599566 0.1607286 0.1446946 0.1599566
LOAD		_	0000	£ 5	00000	FOR FOR	0.1654656 0.1599596 0.1607286 0.1646946 0.15997286
		APP AR ON T STRESS POINT	~~~~	G. ENERT S) AES POIN?	~ N M 4 W	NET ELEMENT STRESS POINT HOR	35 ⊶₩#⊄₽
		120		3 5 5 6		STREET FORMS	

FIGURE III-6.23 STRESS OUTPUT, ELEMENT NO. 4 - LAP JOINT PROBERG

A STATE OF THE PROPERTY OF THE

ITHE FIRST FOLR FCINTS ARE CCANEF PCINTS AND THE LAST FOUR POINTS APE MID-PCINTES OUADRILA TERAL RATIO THE PROR ASPROX FORCES FOR

and the same and a same

		2		34		**	
			၀၀၀၈ ၈၈ ၀ ဂီဇီဝီဂီဗီ ဒီဝီဝီ		၀၀၀၈၀ ၀၀ ဇီဝီဝီဝီဝီဇီ		ପ୍ରତ୍ତିକ୍ତିକ୍ତିକ୍ତିକ୍ତିକ୍ତିକ୍ତିକ୍ତିକ୍ତିକ୍ତି
	-						
	₩0	POWERTS BY		ROMENTS MY		MONEN TS	
₹	~	202	၀၀၀မ ာဏ္အခုခု ပေဒီဒီ ဒီဒီဒီဒီဒီဒီ ဒီ	ğ	၀၀၀၀၀ ၀၀ ဝင်ဝီဒီဒီဒီဒီဒီ	20	ဝင္ဝင္ဝင္ဝင္ ပီဗီပီစီယီလီဗီယီ
H104 (•						
ELEMENT GATO POTHIS	en.						
ER EREK	-	×		#		ş	
YPE	88						
ELEPENT TYPE	M	z		z		ĸ	
13			70000000				0000000
43041			88888838				ខ្ លំឯ ខ ជំងំខ្
ELEPEAT PLPBEF	~	C E S	7.3 CE	83 A		FORCES	43.08 43.08 51.28 75.38 55.78 55.78 55.78
EIE			0. 8854043CE C 0. 16681412E C 0. 56017978E C 0. 22216757E-C -0. 4037557E C	903		5	1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
JMB ER							
NON NO	-	rces	906 02 526 02 526 02 526 02 606 03 176 02 006 00	CE S			456 02 526 02 606 01 006 00 008 00
LOAD CONDITION NUMBER		B. EN ENT FOACES	0.14844990E 0.16852293E -0.3593452E -0.57014160E 0.66263809E -0.58523800E 0.28129000E	APPLIED FORCES FX	0000000	FORCE S FX	0.168649986 0.16852856 0.359936526 0.662538096 0.58125006 0.28125006
1040		E 3		APPL E	351	HEWT P	
		APP AR BY POINT	™ (1) M & M & M & M	el enent Po int		NET ELEMBAT POINT	84964 000

FIGURE III-G.24 FORCE OUTPUT, ELEMENT NO. 1 - LAP JOINT PROBLEM

THE FIRST FCLR PCINTS ARE CCANER PCINTS AND THE LAST FOUR POINTS ARE 410-POINTS) QUADAIRATERAL RATIO 1 2 5 E C T I 9 ---FORCES FOR THE

		24		2		2
	11		ဝပ္စပ္အစ္အေလ ဂ်င်္ခ ်င်္ခ်င်		မာ့သစ္တေတာ့ အာလ မော်လုံလုံလုံလုံလို	ကုစပစ္စစ္စပ စိစ်ဖိစ်အိစ်ခံ
	12	MONENTS MY		Ex 1S		% **
1 0	•	Ş	ဝဝဝငင္ ဝဝဝ ပါပီပီ ပီခံပါ ခ်	§	ရီရီရီရီရီရီရီ	2
PC IN T	*		ರಿಸಿಕಿ ತಿಕಿ ಕಿ		ಕಿತಿ ತಕಕ ್ಕಿತ	**************************************
3	16					
BLEMENT GRID POINTS	€0	ž		ž		¥
2	•	_	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0		00000064 000000000	
			0000000	1	00000066	99000000
rypE	38					
ELEPENT TYPE	*"	2		73		E
ELE						0000000
s.				·		0000000
PLFEF	~		######################################			5855555
EPERT		FCRCES	10947E 104669E 22070E 14857E 14452E 14711E 195339E	FCACES		FORCES FV BI 0347E 304665E 1745467E 134445E 134452E
ELE		u.	0, 9081.05476 -0, 175046496 -0, 30172.0706 0, 40254526 -0, 18737718 -0, 35355536		ာဝမဝဝဗ ဝ ဝ ဒီဝီမီဝီမီနီနီ	#0. #0. #0. #0. #0. #0. #0. #0.
4 9 ER			*			1 1 1 1 1
5 2		↔ I	######################################	w		- 5888858
LOAD CONDITION NUMBER		RESET FORCES	0.533618166 -0.11475566 -0.440172367 -0.213867196 -0.64804688 -0.64804688 0.0	FORCE		FX FCES FX C. 33361416E -0.4134755985 -0.413461386 -0.646046886 C.44508964E 0.0
40 CO		ă E	00000000	1.160	0000000	60000000000000000000000000000000000000
רסי		# ₩	* * * *	T A09	352	
		20 24 CE T PO 241	*****	ELEMENT APPLIED FOXCES POINT		#ET ELEMENT FUNCES FORMS 1 0.53361 2 0.11475 3 0.543361 4 -6.22360 5 0.64900 7 0.44500

FIGHE III-6.25 FORCE OUTPUT, ELEMENT NO. 2 - LAP JOINT PROBLEM

ITHE FIRST FCLA FCIATS ARE CCFARE PCINTS AND THE LAST FOUR POINTS ARE WID-POINTS! QUADRILATERAL RATEO ASFECT I U I T E **4** FORCES

	2	!	N 2.	į	ž
	2	ပေပပ ာပစ္ခ စ္စ ဝီဝီ ဝီဇီဇီဝီ ဇီ	0 0 0 0 6 0 0 d	ခြောမှာ မြောင်းမှ	မာဂ္ဂဗမ္မ ္ အီဗီဗီဇီဇီဇီနီ
•	2				
	E X X		\$ 2.5	5	
	S 13 FIOMENTS RY	02020	MOMER TS	ROKEN TS	
O IN TS	9	ဝေမပစ္စစ္စ မိမိပ်ဆီမီမီမီ	် ဗင္ဇာ ဗိတိဒိန်	0000	ခ္ခရ္ခရ္ မိမိမိမ့်မိမိနှံ
01 3					
ELEHENT GP 10 POINTS	×		¥ £	M	
w			000 00	0 0 0 0 0 0 0 0	
ELEPENT TYPE 38	}				
EP GN1	2		2	æ	
ಪ		00000000	0000		
ELEMENT NEWEER	FC FC ES	-0.3137300E C1 -0.31373005-C2 -0.5537646E C1 6.16111542E C2 -0.21672125E-C1 -0.5538025C C1 6.19206238E C0	99999	Forces	-0.31\$237866 01 -0.313759686-02 -0.\$5376466 01 0.181115426 02 -0.210571256-02 -0.210571256-01 0.192062396 00
HUMBER		79440HH	00000		
1110N	FORCES	4735460E 12687969E 2012961E 2512506E 23437506E 8130890E 65273438E	DRCE S	۶ <u>۲</u>	1969E 02 1637E 02 1637E 02 1061E 02 1764E 00 1764E 00 1764E 00 1764E 00 1764E 00 1764E 00 1764E 00 1764E 00 1764E 00
LOAD CONDITION NUMBER	E d	0.47354640E 0.1268569TE 0.2512506E 0.2732706E 0.234375006E 0.58130890E 0.65273438E	2 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	ij	0.47354646 0.126879695 0.251254815 0.25127946 0.234475006 0.52736366
	APP AR ON T POINT	om えままます。 ○ ここままままます。	型型 型型 20m4v	NET ELEME	まままれるの

FIGURE III-G.26 FORCE OUTPUT, ELEMENT NO. 3 - LAP JOINT PROBLEM

STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET,

8 L E P F R 1 (THE FIRST FOUR PCINTS ARE CERNES POINTS AND THE LAST FOUR POINTS ARE NID-FOINTS) QUADRILA TERAL RATIO * 5 + 6 C T 1 0 H - I FORCES FOR

		Z		7		*	
	61		တ ာ့ အလုပ္သား စီပီစီစီစီစီစီ		စ္စေပေ ခဲ့ အပြင့် မို့ရီဆီဆီကို ဆီလီဆီ		ဖ စ္စ ပ္ပင္စ ဖြစ္ပြင့္ပြင့္
	2						
	÷	10MEN 15		EK 18		ENTS NV	
5 0	=	Ģ	00000000	1	00000000	HONEN TS	••••••••••••••••••••••••••••••••••••••
FOIN T	7.		4444444		ಕರೆರೆಬಿ ರಿಕಿಕಿಕಿ		4444444
5	23						
B.ENENT CRID POINTS	=	¥		¥		Ä	
đ	9		******	_		_	
			0000000		00000000		
1756	*						
ELEPSHT TYFE		2		ĸ		r	
3					6666666		
P 0 C P			This was not not not feel and the				N
A	•	99	5947114E 02 5525626E 61 6113261E-C. 6439968E 51 1798261E-62 1596996-01	5			*******
ELEMENT ALPBER			30471196 6133886 6133886 6163896 64389686 64389686 64389686	FORCES		FORCES	20413 2520 2520 2520 250 250 250 250 250 250
					444444		-6.19547119E 87 0.05525020E 61 6.16113251E-61 6.349345 CE-61 -0.3173451E-67 -6.3173451E-67
			32238233				555 555 555555555555555555555555555555
16k	52	ACES t	0.21474731E 02 0.2087444E 02 -0.14901428E 02 -0.15232101E 02 0.1049004FE 02 0.16403964E 02 0.76403964E 02	CE S			237 200 200 200 200 200 200 200 200 200 20
1 (240)		E STORT FORCES	0.21474731E 0.2017446E -0.14901428E 0.9814628E 0.1049607E -0.7640396E	ED FOR	64450040	SACE S FX	0.21474731E 0.20374446E -0.1523101E 0.10493047E -0.70403364E
LOAD CONDITION NUMBER				APPL E		ENT S.	
		AP A DIT	まようるかきってき	BEMENT APPLIED FORCES POINT	354 	NET ELGMENT FORCES POINT	≈ N A ◆ N ◆ F B

FIGURE III-G.27 PORCE OUTPUT, ELEMENT NO. 4 - LAP JOINT PROBLEM

H. TRIANGULAR RING ASYMMETRIC LOADING (THICK WALLED DISC)

A thick walled disc was analyzed to determine its response to typical asymmetric pressure and thermal loadings. The dimensions of the disc, its pertinent material properties and the subsequent three element idealization are pictured in Figure III-H.1.

Individual analyses of the disc were carried out for the pressure and thermal loadings respectively. The input and output for the pressure loading will be discussed first. Changes in the input and output brought about by application of the thermal loading will be discussed later in this section. Both the applied pressure and thermal loads chosen possessed the same variation (1 + cos 20) in the circumferential coordinate 0. This variation was chosen because it could be described exactly by the MAGIC III program utilizing the (0) and (+2) harmonics.

Asymmetric Pressure Loading

The preprinted input data forms associated with the asymmetric pressure load problem are shown in Figures III-H.2 through III-H.9. The input illustrated in Figures III-H.2 through III-H.7 is completed in a similar manner as that provided for the Axisymmetric Triangular Ring Element (See Reference 5). The only noteable difference between the two elements (Axi and Asymmetric Triangular Ring) being in the input linked to the external loading conditions.

As has been previously indicated (See Section ILC) the difference in manner of input for external loads is quite large between the Axisymmetric and Asymmetric Triangular Ring Elements. Input options specialized and linked to the former must be abandoned when utilizing the Asymmetric Triangular Ring Element. Examples of the options to be ignored in this instance are the Temperature Interpolate Option and Pressure Suppression Options of the Axisymmetric Triangular Ring (See Sections II.C.8).

The only element of the Thick Walled Disc assumed loaded (See Figures III-H.1 and III-H.8) is element number 1. This loading was assumed acting radially outward and possessed a circumferential (1 + cos 20) variation.

H. TRIANGULAR RING ASYMMETRIC LOADING (THICK WALLED DISC)

A thick walled disc was analyzed to determine its response to typical asymmetric pressure and thermal loadings. The dimensions of the disc, its pertinent material properties and the subsequent three element idealization are pictured in Figure III-H.1.

Individual analyses of the disc were carried out for the pressure and thermal loadings respectively. The input and output for the pressure loading will be discussed first. Changes in the input and output brought about by application of the thermal loading will be discussed later in this section. Both the applied pressure and thermal loads chosen possessed the same variation (1 + cos 20) in the circumferential coordinate 9. This variation was chosen because it could be described exactly by the MAGIC III program utilizing the (0) and (+2) harmonics.

Asymmetric Pressure Loading

The preprinted input data forms associated with the asymmetric pressure load problem are shown in Figures III-H.2 through III-H.9. The input illustrated in Figures III-H.2 through III-H.7 is completed in a similar manner as that provided for the Axisymmetric Triangular Ring Element (See Reference 5). The only noteable difference between the two elements (Axi and Asymmetric Triangular Ring) being in the input linked to the external loading conditions.

As has been previously indicated (See Section II.C) the difference in manner ofinput for external loads is quite large between the Axisymmetric and Asymmetric Triangular Ring Elements. Input options specialized and linked to the former must be abandoned when utilizing the Asymmetric Triangular Ring Element. Examples of the options to be ignored in this instance are the Temperature Interpolate Option and Pressure Suppression Options of the Axisymmetric Triangular Ring (See Sections II.C.8).

The only element of the Thick Walled Disc assumed loaded (See Figures 111-H.1 and III-H.8) is element number 1. This loading was as: umed acting radially outward and possessed a circumferential (1 + cos 20) variation.

The Asymmetric Pressure Load Input is accomplished through the form illustrated in Figure III-H.8. The first entry on the form is prelabeled HARM, and requires no input from the user. The second entry on the form contains the information that our problem includes:

- a) one loaded element,
- b) a maximum of two harmonics will be chosen to represent the loading on the element,
- c) and a maximum of two harmonics are to be used for the analysis of the thick walled disc.

The third entry on the form provides that:

- a) the loaded element is Element Number One,
- b) it is loaded in the radial direction only and (36) values of the loading at equally spaced intervals are being provided,
- c) and finally the actual values at these 36 intervals are input.

Designation of points about the structure, in this case the Thick Walled Disc, where output of stresses and displacements are to be provided is accomplished by the form illustrated in Figure III-H.9. The first entry on the form is prelabeled HSDC and requires no input from the user. The second entry on the form provides that output of stresses and displacements will be provided over the entire circumference of the Thick Walled Disc (360°) at (30°) intervals.

A <u>sampling</u> of the output derived from the analysis of the previously described Thick Walled Disc under the Asymmetric Radial Pressure Loading is presented and discussed. Reference should be made to Figures III-H.10 through III-H.19.

Figures III-H.10, III-H.11 and III-H.12 present typical element data output of pertinent material data, gridpoint coordinates, boundary conditions and element definitions (for Elements 1 and 2). This output is consistent with that presented for the Axisymmetric ring element.

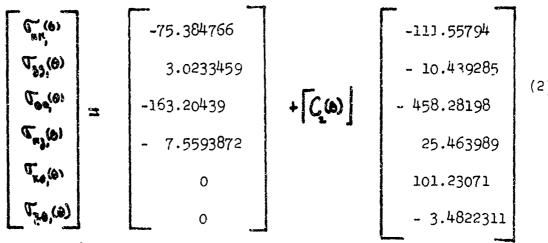
The output presented in Figures III-H.13 and III-H.14 describes the asymmetric loading applied to the thick welled disc. Figure III-H.13 confirms that a radial loading has been placed on Element No. (1), that a limit of two harmonics describing the loading has been set and also presents the 36 circumferential values of

the radial load used to describe the loading. Figure III-H.14 presents the harmonic loads which result from the Fourier decomposition, carried out automatically by the MAGIC III Program, of the loading defined in Figure III-H.13. In the question of the Thick Walled Disc under consideration, the program has determined that the radial loading on Element (1) for a given circumferential location (0) can be expressed as follows (with reference to Figure H.14)

$$P_{\bullet}(\bullet) = - \{100.027 + 98.9766 \cos 2 \theta \}$$
 (1)

Referencing Sections III-C.8f, it is evident that complete two dimensional analyses for the (m=0) and $(m=\pm 2)$ harmonics are required to carry out the analysis of the Thick Walled Disc. This envolves the MAGIC III program assembling structure stiffness matrices for the (m=0) and $(m=\pm 2)$ harmonics. Figures III-H.15 a and b provide the element (for Element #1) harmonic stiffness and load matrices for harmonics (m=0) and $(m=\pm 2)$ which are used in assembling the structure (Disc) stiffness and load matrices.

Figures III-H.16a and b present the harmonic stresses (for m = 0 and m = +2) for Element #1 which result from the above analyses. The harmonic stresses presented in these two figures can be combined as shown below to evaluate the stress in Element #1 at a centroidal location (cross-section) and at an arbitrary circumferential location 8.



The matrix C_2 (θ) is the diagonal matrix

 $[C_2(\theta)] = [\cos 2\theta, \cos 2\theta, \cos 2\theta, \cos 2\theta, \sin 2\theta, \sin 2\theta].$ (3)

Expressions similar to that given by Equation (2) above can be obtained for the displacements and reactions at the nodes of Element #1 for an arbitrary circumferential location θ .

The expressions for the circumferentially varying displacements, reactions and stresses of the nodes (and consequently elements) which define the Thick Walled Disc were evaluated in accordance with the information provided on the HSDC form (Figure III-H.9) by the MAGIC III Program. Displacements, reactions and stresses were consequently provided for all elements at 30° intervals completely around the structure. Figures III-H.17 and III-H.18 provide the displacements and reactions for all five of the structures nodes for two selected circumferential positions ($\theta = 0^{\circ}$ and $\theta = 60^{\circ}$). Figure III-H.19 provides the stresses at the centroid of Element 1 for all 12 specified locations.

Asymmetric Thermal Loading

The Thick Walled Disc was analyzed to determine the effects of an applied asymmetric thermal loading. The loading possessed an $(1 + \cos 2\theta)$ circumferential variation in magnitude and varied non-linearly through the cross-section.

The asymmetric temperature load input for this test case is accomplished through the form illustrated in Figures III-H.20 a and b. The first entry on the form is prelabeled HTEM, and requires no input from the user. The second entry on the form contains the information that the test case includes:

- a) three elements loaded by asymmetric temperature distributions,
- b) a maximum of two harmonics to be chosen to represent the thermal loadings on the elements,
- c) and a maximum of two harmonics to be used for the analysis of the thick walled disc.

The following three entries in Figures III-H.20 a and b provide

- a) the numbers of the three loaded elements,
- b) the information that (36) values of the loadings will be provided for each of the three elements.
- c) and the values of these loadings at (36) intervals for the three loaded elements.

The thermal run is accomplished by substituting the HTEM input for the HARM input provided earlier (Figure III-H.8) and providing the remainder of the input as before. The input for the case of the asymmetrically loaded Thick Walled Disc is reviewed by Figure III-H.21. Selected output from the MAGIC III Program is provided for this analysis in Figure III-H.22 through Figure III-H.26.

Figure III-H.22 describes the asymmetric thermal loading applied to Element (1). The values provided in this figure which comprise the loading must be interpreted as changes in temperature to which the element is subjected at varying circumferential locations. These temperature changes can be imagined as occurring at the centroid of the element cross-section. Figure III-H.23 presents the harmonic loads (coefficients) which result from the Fourier decomposition, carried out automatically by the MAGIC III program, of the loading defined in Figure III-H.22.

Figures III-H.24 a and b present the net harmonic stresses (coefficients in the Fourier series which represent the net stresses on Element 1) for harmonics m = 0 and m = +2. The net stress of Element 1 can be expressed in the following Fourier series form

where the diagonal matrices [] and [] appear as

$$[C_m] = [Cosn\theta, Cosm\theta, Cosm\theta, Sinm\theta, Sinm\theta]$$
(5)

$$\begin{bmatrix} C_{em} \end{bmatrix} = \begin{bmatrix} Sin m \theta, Sin m \theta, Sin m \theta, Cos m \theta, Cos m \theta \end{bmatrix}$$

The net harmonic stress for the A-series, ath harmonic can be expressed as

$$\{S_n\} = [E]\{E_n\} - [SZAEL (m)]$$
(6)

where

$$[E] = \underbrace{\text{harmonic}}_{\text{apparent element stress}}, \qquad (7)$$

and

The vector {SZAEL (m)} is a harmonic stress coefficient correction vector for any element possessing an applied asymmetric (or axisymmetric) temperature load. {SZAEL(m)} is calculated as follows (for the A series, mth harmonic):

$$SZAEL(m) = T(m) [E] { < }$$
 (9)

where [E] is the material property matrix which has the form

The matrix [E] for the Thick Walled Disc (which is constructed using an isotropic material) is

$$[E] = \frac{1-\eta^2}{2}, 3(1+0); 4(1+0); 0; 0; 0; 0$$

$$(1-\eta^2); 0; 0; 0; 0$$

$$\frac{\Delta}{2(1+0)}; 0; 0$$

$$\frac{\Delta}{2(1+0)}; 0$$

$$\frac{\Delta}{2(1+0)}; 0$$

where
$$\Delta = 1 - 3 \cdot 3^2 - 2 \cdot 3^3$$
. (13) The thermal coefficient vector for the Thick Walled Disc (isotropic

material) is

The properties utilized in the analysis (Figure III-L.21) are defined below

$$E = 30 \times 10^6$$
 a)
 $P = 0.3$ b) (15)
 $A = 6 \times 10^{-6}$ c)

The scalor T(m) is the harmonic temperature (coefficient in the Fourier series representing the applied asymmetric temperature loading on the element) and assumes the following values for harmonics m = 0 and m = +2 for Element of the Thick Walled Disc (see Figure III-H.23).

$$T(0) = 353.526$$
 $T(+2) = 349.965$
(16)

The vector [SZAEL(m)] for an isotropic material can be expressed as

where

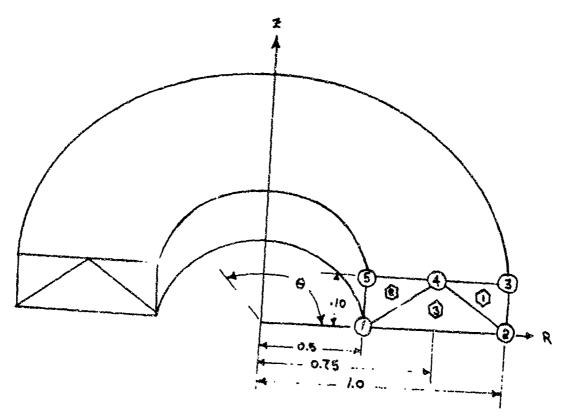
$$\int_{-1}^{2} = \frac{(1+3)^{2}}{1-33^{2}-23^{3}} \times \times T_{m} . \tag{18}$$

Evaluating Equation III-H.18 for harmonics m = 0, m = +2 for Element Number 1 of the Thick Walled Disc:

$$\mathbf{C}_{\mathbf{A}}(0) = .15908656 \pm 06$$
 a) (19) $\mathbf{C}_{\mathbf{A}}(+2) = .15748388 \pm 06$ b)

The quantities $S_{\infty}(0)$ and $S_{\infty}(+2)$ appear as harmonic element applied stresses in Figures III-H.24 a and b.

The displacements for the 5 nodes of the Thick Walled Disc are provided for $\theta=0^\circ$ and $\theta=60^\circ$ (Figures III-H.25 a and b). The net stress distribution in Element 1 is provided in Figure III-H.26.



$$E = 3.0 \times 10^{7} \text{ PSI}$$

$$M = 0.3$$

$$\alpha = 6.0 \times 10^{6}$$

FIGURE III-H.1 IDEALIZED THICK WALLED DISC

THE KE MALLEN BESK SUBSEKKED THE MON-AMERY MANTERS LOADENE MAGIC STRUCTURAL ANALYSIS SYSTEM INPUT DATA FORMAT THIS IS THE FENST BUTHY ON ALL REPORT FORM INPUT RUNS AND IT IS RECURRED FOR ALL RUNS. NUMBER OF TITLE CARDS NEPORT (/) िविष्या ।

TITLE INFORMATION

BMC 1616

(1)

000

3

3

?

2

2

2

FIGURE III-H.2 TITLE INFORMATION, THICK WALLED DISC

BAC 1816.1

	3
ŗ	
ŀ	1 :
F	र्गः
۲.	-1"

MAGIC STRUCTURAL AGALYSIS SYSTEM INPUT DATA FORMAT

		3		
	WANTE DENNETTY	20 M	77000m	\$ \$ \$ \$ ###
Ę	Service of		ă s	11-
MATERIAL TAPE INPUT	74 7.10		# B	
ş	A DESCRIPTION OF THE PERSON OF	+	180	二十二
<u>ئىر</u> 1	J'agili seiri			\$ 5
\\	2'sold solv!	4-4-4		11-
Œ	age? sair?	_1_1	THE NAME OF STATES OF 1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	+1
ş	asalati injustrati	2		111
	steering thank	8	66 6 8	士士士
	Sylvations (8	¥ 0 0	
	3(535)4	13	notessing &	ÿ
	algeneratio	1	100	7-1
	Side.est;	l	1	土土
		E X	A A TION	
			land al-	
	ERIAL IDENTIFICATION	1 3 3	Merchanica & &	2 t
	3	A S	· · · · · · · · · · · · · · · · · · ·	
	Ē		2 70	╁╼╁╼╁╼
	Ž.	9	100 mg	
	7		5 0	
			3 -	
j	¥	711	NO 5	
	{	<u> </u>	noitzerilo R P	y.
	[~ (3)		
ĺ			10 mg	口
	FOOK COME			H
ľ	J	ंतु ह	TELMENATURE 7 8 9 0 0	
-	ATEMAL PASER		F 60	
	FS C	R	777.53	

MATERIAL

366

2 3 5

3 3

3

FIGURE III-H.3 MATERIAL TAPE INPUT, THICK WALLED DISC

MAGIC STRUCTURAL ANALYSIS SYSTEM INFUT DATA FORMA?

SYSTEM CONTROL INFORMATION

	enter appropriate number, right adjusted, in box opposite applicable requests	8 Y S T E M (/)
1.	Number of System Grid Points	1 2 3 4 5 6
2.	Number of Input Grid Points	7 8 9 10 11 12
3.	Number of Degrees of Freedom/Grid Point	[3] 13 14
4.	Number of Load Conditions	15 16
5.	Number of Initially Displaced Grid Points	17 18 19 20 21 22
6.	Number of Prescribed Displaced Grid Points	23 24 25 26 27 28
7.	Number of Grid Point Axes Transformation Systems	29 30
8.	Number of Elements	31 32 33 3½ 35 36
9.	Number of Requests and/or Revisions of Material Tape.	1 37 38
10.	Number of Input Boundary Condition Points	39 40 41 42 43 44
11.	To For Structure (With Decimal Point)	45 46 47 48 49 50 51 52 (/)

FIGURE III-H.4 SYSTEM CONTROL INFORMATION, THICK WALLED DISC

MAGIC STRUCTURAL ANALYSIS SYSTEM INPUT DATA FORMAT

COORD

GRIDPOINT COORDINATES

_	_			-		······································				_			_	_	_			-	D		1	R		E			7		1	0		N	5			-	•••	mPr()+	Nes-re		-	7
į			Grid Point Number X											F	ł				Y-0 Z-Z																							
	C	١	<u>.</u>	1	<u>.</u>	è	1	3		3	4			3	7	8		20	t	2	1	}		5	8	7	8	,	30	;	2	3	4	3	•	7	\$	9	40	1	1 2	,
į	8	L	ļ	1	_	_		1	k	į	•	L	į		1	1	1				0	Į,	k	1	1	I				I			J	4	1			Γ	Γ	T	Τ	1
			1	ļ	1			9	•	۱		_		-	1	1					e	I	I	1	I	T	I	I	Ì	T	I			d	Ţ			Γ	Γ	Γ	T	1
Į	*	Ĺ	L	j	1	_		3	1		•	0	1	ĺ.	1		1	1			ð	Ι.		į	T	Ī	T	Ţ	Ţ	Ţ	1	Ŋ.		īŢ	Ţ			Γ	Γ	Γ	Γ	1
į	Ä	L	L	ĺ	ĺ			4	ķ	I		1	9		Ţ	T	T	T			9	Ţ,		7	T	T	1	T	1	7		Ŋ,			1	٦		-	T	T	T	٦
İ	ä	Ĺ		ĺ									Ŀ		T	1	T	1	٦		1	ļ.	d	-	Ť	Ť	Ť	†	1	†	-	7		i	†	1			T	T	T	1
ĺ	8			Ι	I				Γ	7		Γ	Γ	T	Ť	T	1	î	٦	_	r	t	Ť	T	†	T	†	Ť	†	†	†	+	1	†	†	1	_	۲	f	t	Ť	1
	**			Γ	I				Γ	Ī			Γ	T	T	T	Ť	1	7	_	r	T	T	T	Ť	t	†	Ť	†	†	Ť	†	t	t	†	1	-	-	1	t	t	1
	*		Γ	ſ	T	1			T	T			Γ	T	T	Ť	†	†	1	-	r	1	t	t	t	T	†	†	†	t	†	†	†	†	†	1	٦		H	۲	t	1
ľ				Γ	T	1	٦		Ī	Ì		Г	<u> </u>	T	T	T	†	t	†	٦	۲	t	t	t	†	t	t	†	t	t	ţ	†	t	†	\dagger	+	4		H	-	+	1
	8		Γ	Γ	Ť	1	1	-	r	t	1		T	T	T	t	†	t	†	٦	۲	H	t	t	t	t	t	t	†	+	t	t	t	t	t	1	٦	-	Н	H	+	1
000	8		Γ	T	Ť	Ť	7		T	t	1		-	T	t	t	†	t	†	٦	┝	┢	1-	t	t	t	t	\dagger	t	\dagger	+	十	t	t	t	+	4		Н		-	1
Š	8	-	ı	T	t	†	1	-	r	t	1	_	۲	f	t	t	t	t	†	4	-	H	H	t	t	╁	╁	+	\dagger	\dagger	╀	╁	╁	+	+	+	┨	_	Н	Н	-	ł
Ž	Ž,		1	t	t	†	1	_	H	t	1	-	-	t	t	t	t	t	+	4	_	-	 	┞	╁	H	╁	╁	╁	╁	╁	╁	╁	╀	+	╁	-	-	Н	Н	<u> </u>	l
Š	ŝ	-	r	H	t	t	†		┝	f	+	-	-	H	t	╁	╁	╁	\dagger	4	_	-	┞	┝	╀	┝	╀	╁	╀	╀	╀	╀	╀	╀	╀	╀	4	-	H	_	-	l
	8	_	┝	-	t	t	7	7	-	ŀ	+	-		-	┝	H	╁	╀	t	┨	_	١.	┞	┝	┝	┝	╀	╀	╀	╁	╀	╀	╀	╀	╀	+	4	4	4	-	<u>_</u>	l
		-	-	H	t	t	+		H	H	†	٦	-	┝	┝	┞	╁	╀	+	+	4	_	\vdash	\vdash	┞	┝	╀	╀	╀	╀	Ł	┞	╀	╀	╀	╀	4	4	-	-		ł
	i	٦	-	┝	t	t	+	٦	Ι	H	+	-	_	H	┞	\vdash	╀	Ļ	+	4	4	-	H	-	┞	ļ.	╀	╀	╀	╀	╀	Ļ	Ļ	Ļ	+	4.	4	4	\dashv	4		İ
	8	+		┝	H	+	†	-	-	┝	+	4	_	-	\vdash	-	╀	╀	+	+	4	_	<u>_</u>	-	\vdash	L	<u> </u>	╀	Ļ	+	 -	L	-	L	ļ.	1	4	4	4	4		
	Я	4	-	-	+	╀	+	4	-	}	+	4	-	-	H	H	┞	┞	╀	+	4		_	L	L	-	L	┞-	╀	Ļ	1	L	L	Ļ	Ļ	ļ	4	4	4	4	-	
	٠.	4	_	-	+	+	+	+	4	-	╁	-	~	H	H	H	Ļ	H	+	+	4	_	L	L	L	L	L	1	ļ.,	L	 -	L	L	L	Ļ	1	1	4	4	4		
Ä	1	4	-		H	╀	+	4	4	-	+	4	4	H	L	-	Ļ.	L	+	4	4	_	Ц	_	L	L	L	L	L	L	L	L	L	L	L	ļ	1	_	1	1		
	1	4	-		Ļ.	Ļ	+	4	4	L	+	4	4			Ļ.	L	L	Ļ	1	4	_	Ц		L		L	L	L	L	L	Ц	L	L	L	L	1	┙	⇃	1		
	1	+	4	_	-	Ļ	ļ	4	4	_	ļ	4	4	4			Ļ	L	Ļ	1	4		Ц	Ц	L		L	L	L	L	L	Ц	L	L	L	L	1	Ţ	1	1		
	1	+	-		_	Ļ	1	4	4	Ļ	ļ	4	_	_			L	L	L	1	_			Ц	L		L	L	L	L	L	Ц			L	L		\int				
	1	+	4	_	-	L	1	1	4		ļ	1	4	_	_		L	_	_	1	1								L									\int		J		ı
į	L	1	4	_	_	L	L	1	_			1]					L	L										Γ						Γ	Γ	Ī	T	Ţ	T	٦	
	į.	1	1			L		1		_										Ţ	Ţ									П		٦		Τ,		Ī	T	†	†	†	٦	
	L	1							T	_	Γ	I	1						Γ	T	T	7	7	٦	7	7				П		7	٦	_		٢	t	†	†	†	ᅥ	

FIGURE III-H.5 GRIDPOINT COORDINATES, THICK WALLED DISC

MAGIC STRUCTURAL ANALYSIS SYSTEM INPUT DATA FORMAT

BOUNDARY CONDITIONS

INPUT CODE - 0 - No Displacement Allowed 1 - Unknown Displacement 2 - Known Displacement

PRE-SET MODE

1	9	3	4		6
M	0	Ö	A	·	

TRA	nslat	ONS	RO	TATIC	XVS	GEI	VERAL	ZED
U	٧	14	Ф×	Đ٧	Øz.	1	2	3
13	14	16	16	17	18	13	20	21

LISTED INPUT

G	P N	d i	e!	nt ir	Nepes										
7	8	•	ö	1	3	13	14	15	16	17	18	12	26	21	
				ŧ		1	8	1] (
			L	2		Ì	Į	•] (
				3		1	1	1] (
_		Γ	Γ	H	П	1	à	•] (
		Γ	Γ	5	П	ı	1	0] (
_	Γ	Γ	Γ		П										1
			Γ		П] (
_		Ī		Ī	П										1
	Γ	Γ	Γ	Γ	П										1
	Γ		Γ												1
•	Γ	Γ	Γ	Γ											1
•	Γ	Γ	Ī												1
•		T	ľ	Ī											1
•	Γ	Γ	Ī	Γ											1
•	T	Γ	T	T	П										1
	T	T	T					1			<u> </u>				7
_	T	T	T	T											1
-	T	T	T	T	Γ			 							1

FIGURE III-H.6 BOUNDARY CONDITIONS, THICK WALLED DISC

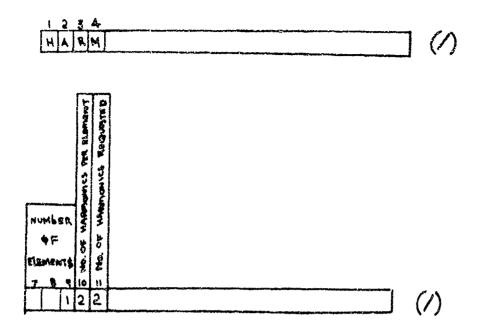
#AC 1626

MAGIC STRUCTURAL ANALYSIS SYSTEM INPUT DATA FORMAT

ELEMENT CONTROL DATA

	1	7	-	}	<u>ک</u>	<u> ک</u>	<u> </u>	<u>-</u> 2	2_	3	<u> </u>	<u>_ </u>	<u> </u>			<u> </u>	5	<u> </u>	<u>S</u>	<u>S_</u>	<u>S</u>	<u>S</u>	\overline{z}	2
	~		0	1	1					上	<u>† </u>			_	+-	+	+		+	-+	+	\dashv	{	
1	-	4	ႌ	+	-					-	-	1		I	T	1	1				士			
	=	-	~ -	+	+	-		-	-	┿	┼—	┼		╂	+-	+	4	+		_	_[\Box	
			0	I								1	†-	†-	┿	十	+		+	+	+	-+	-	
			1	+	-	_				П				Τ			工	1	土	土				
ĺ	0	1	-	-	+	-		-	-	┼	┼	├	╀╌	┼-	-	4	4-	4	_	\perp	1	\Box	コ	
			寸	1	-						-		 	+-	+	+-	+-	~┿~	+	+	-	+		
	•	9	+	+-	-		_			-					I	I	I	I		工	士	士	1	
*	 		-	┿	-	-		-		 -	 	-	-	┿	┿	+-	-	_	4.		工	\Box	_	
~			•								-	 	-	┼	+-	╁	十	+		┿	-+-		-	
× ~		+;	4	-	<u></u>				-								土	土	士			1	十	_
0	~	1		┿	+	-+					-		-	-	-	T	T	Ŧ	T	Ţ	Ţ	\Box	7	
		4		I	I										1	+	+	┿	┿	╁	+	+	┪	
		1		+-		-				_					L			I					二	
	L			士	士						-	-		┢	┼	┿-	┪		+-	┿	+	-	-+	
w	_	90	-	Ţ	Ţ	\exists	\Box									上	1					1	-	-
۵	•	- 0	-	+-	+	+	-+							_	ļ	1		\perp	T	I	I	I	I	
Ö	***************************************	Ŀ	\mathbf{I}		士	+		-	_					├	+-	┿	┿	- }	+-	+-	-	-	+	
X	**	8	·	-	T	7	\Box	_							二		上	土		\pm		1	+	
		+;		1	<u>, </u>	H		-+				-		├	-	-	4_	-	_	1	1	T	Į.	_
Í	10	~	1		I		Ì	=t				_		├	+	+	+-	+-	+-	┿	┿	+		
	-	1	m	-	+-	.			_			\Box				二							士	
	~	40	1		土	<u>*</u>	\perp				_	\dashv				╫	+-	╁	+-	┿	+-		+	_
	-	6	5	-	-	_	-	-									1	1	1	#		士	1	_
	••					1	+	+	-						├	-	┿	┿-	┿┈	+-	+-	+	+	
1	1 361	77.00		_	-	Ţ	Ţ	\dashv			\Box				二				工	工		士	土	
W9 14	A to . of	1 8	<u> </u>	L_		Ì	-				- 1	-	Ì				1		Γ		T	Т	T	
TA edba	TodmuN P Inee!	23	10	35	ाट	1	7	コ	\Box									<u> </u>	士	+	-	+	+	
7	110	ß	×		た	+	+	+	-		-		-				-	-	-	 	 	+	Ţ	\exists
٠ h	TOR.			-	-	4	-					_		*****	<u> </u>		<u> </u>	_	丄				L	
PRINT	Elam.			L.		L			\perp			[Ì						_
-	talvq	8	١.			T		7	\top	\Box		\top								1	†	†	7	~
ire	elem. In	8			 	╈	+	十	+	-	+	-					├	├	┼	┼	╬	+-	+	4
840	infa l i	-			┿-	+-	+	+	·		-	4						L	<u> </u>	L	↓_	\perp	١,	
7013	10060 N	R			ĺ				-				- 1				1		1		1			
	**************************************	<u>_</u>			├	┿-	-	+	-	_	4	-	_					<u> </u>	<u> </u>	_	$oldsymbol{\perp}$		L,	
د	K	9				+	+	+	-	-	-+	+	-+				-	-	├	 	┼	┿~	+	4
	Ę	4 5				Ţ	T	I	\Box	\Box		二											1	┥
W	ER	3			-	+-	+-	+	+	-	-	+	-						-		_	Ι_	F	7
KATERIAL	EMPERATURE	2				I		工	土	\exists	士		1		.	-			╫	├─	+	┿-	┿	-
28	W	92				┿	+	+	+	-		4	\dashv	\Box									士]
51816 00	quetni iteo	9				T	十	_	7	十	十	+	-		-	\dashv			-	-	├	┼-	+-	\dashv
		- 80	크	त	7	╁	┿╾	+	+	+									<u> </u>		<u> </u>	Ļ	Ļ	4
4	X DE SER	-	=		75	Ĺ	1	工	工	\Box			士							_	-	┿	╁	┥
į.	3	8				┝	4-	+-	+	-		_	-	_	_]
KATEBIAL	3	<u> </u>	二				士	1	_	+	+	+	+	-+					 		-	-	+	4
	อกาส	2 3					T	T			I		工										-	\dashv
U 14	. 1	Ë	<u></u>	(5)	m		-{	+-				+	-	-7	\dashv	7	_]
M 24	HKUM [-0	=	可	सर		1	#	二	士	士	士		士		\exists					_	_	+-	\dashv
TME	K373			_}			_		+	-+-	+		-	\dashv			\dashv	—			F		二	7
,,		~		-				-	-				i			- 1	- 1						1	- 1

FIGURE III-H.7 ELEMENT CONTROL DATA, THICK WALLED DISC



17

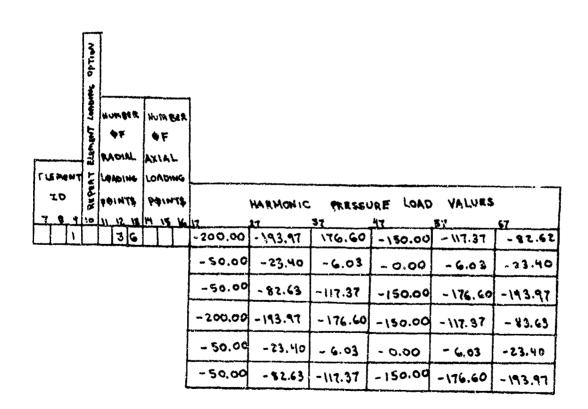


FIGURE III-H.S HARMONIC PRESSURE LORD INSUT,
THICK WALLED DISK

5.*

*

MAGIC STRUCTURAL ANALYSIS SYSTEM INPUT DATA FORMAT

TRIANGULAR RING ELEMENT (ASYMMETRIC LOADING)
HARMONIC INCREMENTS



FIRC.	2 0	360
	S 7	द्र
MC. YALUR	2 3 4	
REF.	. 6	0

DESIGNATION OF STRESS AND DISPLACEMENT OUTPUT LOCATIONS; THICK WALLED DISC III-H.9 FIGURE

TALCK WALLED DISC SUBJECTED TO MON-AKISTAMETRIC LOADING

:

REVESIONS OF MATERIAL TAPE

ASTERISK (*) PRECEEBING MATERIA, SDEMTIFICATION INDICATES THAY INPUT EMACK METARKA MILL NOT RESULT IN TERNIMATION OF EXECUTION 04 300000E 00 DERECTIONS DIRECTIONS 0-3000000 00 POISSON'S RATIOS RIGIDITY MODUL! INPUT CODE 0.30000 39 0. 300000E GG **DIRECTIONS** DIRECTIONS YOUNG'S MODULE TH. EXP.COEF. KK 0.300000E 08 MATERIAL PROPERTIES TEMPERATURE TEMPERATUR E 0.0 373

2.X 0. 300000 00

C. IISBUSE OR

72 0.1153826 00

0-115345E 08

22 0-4040606-35

0. 6 00000E-05

3.6000000.0

0

FIGURE III-H.10 TITLE AND MATERIAL DATA COTPUT, THICK WALLED DISC

:

M 10 14 spends 4 ...

The state of the s

NO. DIRECTIONS = 3 NO. DEGREES OF FREEDOM = 1

					GRIDPOINT DATA IIN RECTANGULAR COORDINATES!	DAT A COORDINATE	s s		
				;			TEMPERATURES	POE SSURES	.E S
POINT	× × × × × × × × × × × × × × × × × × ×	ć	0.0	>	0.0	ł	0.0	۵ · · · · · · · · · · · · · · · · · · ·	
art.	0. 500000000000000000000000000000000000	2))				0.0	, O	
ev	0. 1CC00000E 01	10	0		0.0		000	0 0 0 0	
•					10.2 44000000	16.34	\$ 0 0 0 0	000	
m	0.10C00000E 01	5	0		9 6 6 6 6 6 6 9 9 9 9 9 9 9 9 9 9 9 9 9	3		000	
•	0.75000006 00	8	ဝ		0.9999964 E01	54 E01	ာ ဝ င	000	
			,		0.000000000000000000000000000000000000		00	0 00	
ir.	0. 500000000	00	င ဗီ				0.00	၀ မ	
374						1 MCOOMAT 5	ž		
				Š	こうできていることでは、こうできないと、人名の記念のの				

NO. OF THOS	0000
NO. OF SMES	m 9 6 2 4
DEGREES OF FREEDOM	
DEGREE	ed ed ed ed ©
	14 14 14 14
	ल्यं इस्तं इस्तं इस्तं
NO DES	ન્ય ભાજ જે જે

FIGURE III-H.11 GRIDPOINT DATA AND BOUNDARY CONDITION OUTPUT, THICK WALLED DISC

1

```
------ MCTien PRIPTASIES----
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     ethe mis pri
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                PISGRE III-R.12 PINITE KINGER DESCRIPTION COTFOT, THICK MALLED DISC
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             0.169803061 00
0.20980504 00
0.30980504-65
0.115306066 00
2 3 4 CONTS-----
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           E. Het.
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  ¥.~
                                                                                                                                                                                                                 PACTOR LAN. THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE ST
                                      i i
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     MATCHER, SENTERS ... STATES ... SAME THE STATES ... SAME THE SECOND ... SAME THE SECOND ... SAME THE SECOND ... SAME THE SECOND ... SAME THE SECOND ... SAME THE SECOND ... SAME THE SECOND ... SAME THE SECOND ... SAME THE SECOND ... SAME THE SECOND ... SAME THE SECOND ... SAME THE SECOND ... SAME THE SECOND ... SAME THE SECOND ... SAME THE SECOND ... SAME THE SECOND ... SAME THE SAME THE SECOND ... SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME THE SAME TH
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        PROPERTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF T
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             FUND MATTER ALTER THE STREET THE STREET THE STREET THE STREET THE STREET THE STREET THE STREET THE STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET S
                            1 31 12 0 0.0
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       E. St. 12 3 C. 0
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            BIT GENELATED PLANTE: PROPERTIES
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             DATEMBELATED PLASTEE PLOPERTIES
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 HATTORICATOR PLASTIC PUSTONIES
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     B.25 TYPE 6.65 -38. CODE 3 31 12 0
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          PARTY SEES PROVIDE
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       Post services
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              PRE-CPRAME COPAT
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        NACH SERVICE SAPER
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             PAGE SER PROFIT
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         THE PARTY HOUSE
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               ATTENNE NO ST
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          MINER POR
```

GITCA 65 10 PTS

Commonwealth of the Common

Secretary of the secret

HARRONIC LOADS (PRESSURE)

	S											
	900	3	Ş	3	8	8	8	3		8		
	-0-1 766 GOE	ğ	00K	800	30	304	***	8	900	200	200	306
	4	32	900691	-0.2346006	-0.5117370E	-	Z	32	8	3	1173	1
		Ģ	0.0	3	9	-0-1	급	Ģ	4	-0.234006E	10.1	Ģ
<u>.</u>	_	•	•	Ņ	*	00	=			30		
4	-0.193970E 03	•	~	-	~	-	~		700	en	~	en en
GADS	2	*	ب س	<u>ج</u>	Ö	9	e e			9	ë	9
2	1193	25	88	6.663000	-0.6263006	8	-0-1 93#70E	50.11.13 TO	-0.534000E	-0.4030000	-0°826300E	-0.1 T6400E
	9	-0-11731	00-23400	9	.824	17.	200	127	Ä	3	200	327
	~	•	Ş	9	9	9	•	ô	Ģ	Ç	ő	9
PUSHT	80	89	•	çal (7)	14	1	2	2	%	ž	32	%
Ş	-0.200000E 03	6	20		70	60	É	60	70		~	63
	Š	-0.198000E	-0. 500000E		ğ	ğ	-0.200000	ğ	3		ğ	Ä
	× 0	ğ	ž		ğ	ž	ğ	ğ	ğ		-0. 500000E	ğ
	•	4.0	ģ	9	9	9	ę		ģ	000	ė,	å F
4.	-4	£	ŧ		ŧ	•	£	•			•	•
POEN		•	~	9	:*\ ==1	=	S	22	ž	2	Ħ	36
Į												
₹ %												
- E	N											
905	N											
REER OF HA	R											
MUMBER OF MARMONIC	***											
DERECTION OF NUMBER OF LOADING (DADING	RADIAL 36											
DERECTION OF NUMBER OF LOADING (DADING	RADIAL 36											
	RADIAL 36											

PIGURE III-H.13 ASYMMETRIC LOAD DATA COTTUT, THICK WALLED DISC

RESULT OF RAROREC ARALYSES

ELEMENT HARMONEC COEFFICIENT FOURIER COEFFICIENT ND 6.6 - 100001E 03 0.20000E 01 - 5.909745E 02

FIGURE III-H.14 HARMONIC LOAD CUTPUT, TRICK WALLED DISC

And the second s

FOW 2 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0		GRID POINT NUMBERS 2 3 4 2 3 4 STIFFYESS HATRIX C. 0 C.	0.29074739£ 09 -0.29074739£ 09 -0.29074739£ 09 -0.29074739£ 09 -0.29074739£ 09	31 9.13359970E 0% 0.0 0.8760174AE 0% -6.46135072.E 0% -6.46135072.E 0%	0.120000000 61 0.0 0.0	0.306633046E 09-0.45311232E 04-0-1329132E 04-0-13291332E 04-0-1329132E 04-0-1329132E 04-0-1329132E 04-0-132914E 04-0-13291E 04-0-13291E 04-0-13291E 04-0-13291E 04-0-13291E 04-0-1329E
31424088	8	THERML AND PRESSURE LCAL	LCAD MATRIX 0.5 9.0	-0.314240868 02	e • • • • • • • • • • • • • • • • • • •	3 -6

PIGURE III-H.154 HARMOHIC STIPPHESS AND NODAL LOAD MATRICES FOR HARMONIC (m. = 0), KIRMENT NO. (1), THICK WALLED DISC

377

							0.47745468 88		ŧ	-0.5821784Œ 07 0.45311430E 07	-0.30207490E 07 -0.64259536E 07	•
end the						0,67019429£ 66	0-104041906 07	0.43300848E 08	-0.22847728E 06 -0.	0.35151040E 07 -0.	-6. 14414194E CB Co.	-6.159467BJE 62 6.0
PLUS MARGER					0.145993346 09	-0.27186764E C6	-6.7551877b£ 07	-G.14518397E 09	0.226555446 06	-0.45311430E 07	0.21969431£ 96 0.68653290£ 07	LGED PATRIX 6.6 6.5
ELEMENT NUMBER 1	GRID POINT NUMBERS 2 3 4	Stiffness matrix		5. 42359232E G6	-0.15103760E 0Y	0,23067450E 07	-0,413156%E GB	6.7551 8940E G7	-0,13141520€ 07	6.14280020E 07 0.86777290E 07	0, 30207450E 07 0, 0	THERMAL AND PRESSURE (9 x 1)
			0.42947296E 68	MOH 2 0.49433494E 06	NOW 3 -0.22655770E G7	AON 4 -0-4021 72 COE 96	70 y 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	MOW 6-0-143463646 08	ROW 7 -6-49432019E G6 0-21059136E 06	RGW 6 0.17024140E 07 -0.10990400E 06	0.16614154E 02 0.8	-0.13544733E &c

FIGURE III-H.15b HARNOMIC STIFFMESS AND MODAL LOAD MATRICES FOR HARNOMIC (4 = +2), KLEMERT No. (1), THICK HALLED DISC

... ... 3 E C 7 1 0 M C R 3 S S (SPRESSES EVALUATED AT THE ELEMENT CENTROLD) ASYMPTETE TRIABELLAR *** л 6 \$ 7 2 E S S E S

		ETA 9	KTA)		£ 75		
	64 64 54 54 54 54 54 54 54 54 54 54 54 54 54	I 0.6 Ser	SHEAR STRESSES (R-TMETA) (Z-TMETA)	0.0	SKEAR STRESSES (R-TWETA) (2-TWETA)	0.0	
OINTS	€3 €4 €4	(R-1	* * * * * * * * * * * * * * * * * * *	0:0	6 A 8 8 4 4 5 1 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4	9 9	
GENEAT CATO POINTS	4 K	26 01	R N		**	26 01	
4	~	(RZ) -6.75593872E 01	(82)	•	(42)	-6.755938728 01	
BLENENT TYPE	31 Cercentement lal	(TWET A-THET A) -0.14320437E 03	CIRCUMERENT LAL (THET A-MET A)	•	CINCUMPERENTIAL (THET A-THET A)	-0.16320439E 03	
ALPHO EA	-	5				5	
ELEMENT MINBER	ABIAL	0. 3023345 91 0. 30233459E	AXS AL (22)	•	AX8AL (22)	A 36233454E 01	
RUNDER	æ	8	Sign 1			8	
LOAD CONDITION NUMBER	APPARENT CLEMENT SINESSES STRESS RADIAL	(RR) -0.75304764E 02	APPL RED STRESSES RADIAL (RR)	•••	MET SK. EMSMT STRESSES STRESS RADEAL POSTAT (SR.)	-0.75384764E	
-	APPARENT STRESS	8	STRESS PODET	~	net a eri Staees Point	-	379

PIGURE III-N.16m. MANNORIC STRESS CORPFICIENTS FOR ELEMENT NO. (1), RAPHONIC (4 = 0), THICK WALLED DISC

A CONTRACTOR OF THE PARTY OF TH

92 2 SECTION CROSS (STRESSES EVALUATED AT THE ELEMENT CENTROLD) ASYRPHYRIC TREAMGULAR 4 X E # () #. STRESSES

	A) LE O1	₹	A) 1 E O3
	5 82-theta) -0.34022311E G1	S (2-THETA) 0.0	S (2-THETA) -0.34822311E 01
	พ พ	w •	w .s
	R STRES in-theta) 0.10123071E 03	# # E	. R S T R F S (R-TMETA) 0.10123071E 03
213	SHEAR STRESSES (R-1967A) 2 0-10123071E 03(SHEAR STRESSES (R-THETA)	S H E A R S T R F S S E S (R-THETA)
B. EMENT GRED POINTS	2 N	3 # S	Z M A
MONT OF	:3 9989€ 0		. S
ŭ ~	(RZ) 0.29463989E 02	(RZ)	(RZ) 0.25463989E 62
17PE	NT SAL EFA) SE 03	# 5 A 1 A 1 B	T TAP T AP E 03
ELEMENT TYPE	CIRCUMPERENTIAL (THET A-THET A) -0.458 28 194E 03	CIRCUMFERENT SA. (THET A—THET A) 6.0	CIRCUMFERENTIAL (THETA-THETA) -0.45826198E 03
MENT AUMER	\$		
ELEPENY	ANIAL (22) -0-10439289E 02	0°0 4223 0°0	AK! AL (22) -0-10439285E 62
NUM BER	·		·
LOAD COMBITION NUMBER	APPARBIT REFRENT STRESSES STRESS RADIAL POINT (RR.5 1 -0.111557941 03	REMENT APPLIED STRESSES TRESS RABIAL CINT (RR) 1 0.0	NET & EMBNI STRESSES STRESS RADIAL POINT (RR.) 1 -0.11155794E 03
3	APPARENT I STRESS POINT	A. Enght ar Stress Point	NET BE ENGRESS FORMS

FIGURE III-H.16b HARMONIC STRESS COEFFICIENTS POR ELEMENT NO. (1), HARMONIC (4 = +2), THICK WALLED DISC

į

DISPLACEMENTS

3	0.544077E-06 -0.49834&E-09 -0.418975E-05 -0.193829E-05
>	9 0000
2	-0.296247E-04 -0.299754E-04 -0.28930E-04 -0.28558E-04
GRID POINT	■ひき より
THETA	0000

PIGURE III-H.17a MODAL CIRCLE DISPLACEMENTS AT 0 = 0°, THICK WALLED DISC

ţ,
Ē
W
ᇳ
3
₹
=
3
=
0

33	-0.2994636-05 -0.2994636-05 -0.3994636-05 -0.1560466-05
>	0.1921146-04 0.2520346-05 0.2345666-05 0.1080746:04
3	0.767113E-05 0.76471E-05 0.816699E-05 0.851580E-05 0.820817E-05
GRED POINT	≈ N M ◆ N
THETA	99999

FIGURE III-H.17b NODAL CIRCLE DISPLACEMENTS AT 8 * 60°, THICK WALLED DISC

An all the second secon

32	-0.146484E-02 -0.103474E-02 -0.61988E-04 0.11749E-02
>	0.1068125-03 0.1220705-03 -0.1525885-04 -0.9135275-04
ə	0.109502E @1 -0.137329E-03 -0.427246E-03 0.24795E-04 -0.991821E-03
GRID POINT	લ્લ ભ ર ભ ન⁄ ધ
THEYA	00000

FIGURE III-H.18% NODAL CIRCLE REACTIONS AT 6 " 0" THICK WALLED DISC

REACTEONS

3 :	0.132376F-03 0.517396F-03 0.309925F-04 -0.567427F-03
>	0.130344E=02 0.137509E 02 0.137500E 02 -0.109588E=02 -0.104627E=02
Þ	-0.546215E 00 -0.480445E-03 0.946017E-03 0.102042E-03 0.51876-03
GRID POINT	ed NJ 170 4학 3N
THETA	00000

FIGURE III-H.18b NODAL CIRCLE REACTIONS AT 9 = 60°, THICK WALLED DISC

And the state of t

NET STRESSES FOR THE TRIANGULAR RING ELEMENT

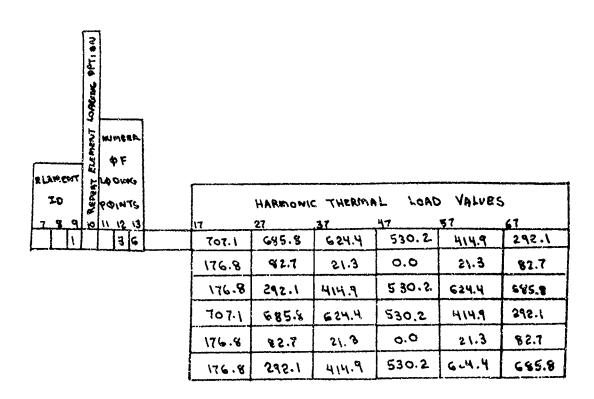
(STRESSES EVALUATED AT ELEMENT CENTROLD)

SEE AND SEE AN	A-IMETA	-0-3025640F A	-0.30157206 01		0-3024600				TO STANDANCE OF				0.3015907E 01
SHEAR	0.0	G-8756806E 02	G. 8766896E 02	Q. 1704743E-02	-0.8766721F 02	-0-8764982F 02	-6,340452 EF#02	0-8764346 02	0-82470425-02	0.51142726-02		20 31ccon 6 0c	- C. 8767146E 02
SHEAR	0.1790460E 02	0.5172737E OL	-0.2029111E 02	-0.3302330E 02	-0-2029187E 02	0.5171372E 01	0.1790460E 02	C. 517348GE OF	-0.2029039E 02	-0-3302338F 02	CD 20700000000000000000000000000000000000	20 110111111	Destricate of
MORMAL AX FAR	-0.6214863E 03	-0.3923477E 03	0.6593187E 02	0.2950774E 63	0.6594560E 02	-0.3923337E 03	-0.6214843E 03	-0.3923611E 03	0.6591886E C2	6.2950774E 03			-0.376360E US
MORFAL CERCUMPERENTIAL	-0.7415939E 01	-0.2196350E 01	0.8242361E 01	0.1346263E 82	0-82431946 01	-0.2196036E 01	-0.7415939E 01	-0.2196694E 01	0.6242565E 01	0.13462636 02	0.8243498£ 01	20 2147496	10 351647.00
	-0.1869427E C3	-0-1311643E 03	20 3649 R 00-	0. 361 731 7E 02	-0-1960361-02	-0-1311609E 03	-0.1869427E C3	-0-1311676E C3	-0.1961011E 02	0.36173176 02	-0.1960036F C2	-0.1311878F #3	***
CIRCLMFE- RENTEAL	0	۵ (2 9	9 6	27.	001	091	017	240	0.22	300	330	
ELEMENT TYPE	31	-	7 -	·	4 o	-d , 5 (ad 0	~ •	-1 c	# £	PÅ M	37	!
EL ENENT MUNISER	- 4 +	4 p	•	1 -	4 p	٠.	= 4 •	┥,	┥•	◄ (rd.	mi	

FIGURE III-H.19 STRESSES IN ELEMENT NO. (1), THICK WALLED DISC

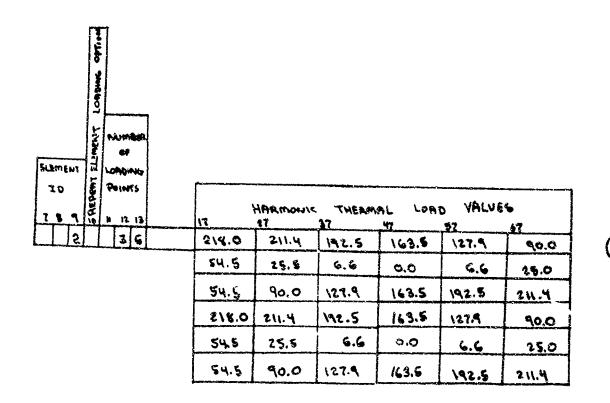
	PAR ELEMENT	REGUESTS
Number	HAIRBURDANC.	HARMONK
ΦF	10	#
ELEMENB	Ž	Ž
122	10	للا
3	2	2

(/)



(/)

FIGURE III-H. 20a HARMONIC THERMAL LOAD INPUT,
THICK WALLED DISK



ELEMENT TO SO WISE STANDING TO SEE SON WISE TO SO WISE	₩	HARONIC "	THERMAL	LOAD YA	LV#\$	
		37	31	47	57	<u>e</u>
3 36	976.0	946.0	961.8	732.0	\$72.8	403.2
	244.0	114.2	29.4	0.0	29.4	114.2
	244.0	403.2	8.572	732.0	861.8	746.6
	976.0	946.6	861.8	732.0	572.8	403.2
	244.0	114.8	29.4	0.0	29.4	114.2

FIGURE III-H.306 HARMONIC THERMAL LOAD INPET,
THICK WALLED DISK (CONTINUED)

•	9
•	567690123456
•	678901234
*	789012343
*	18 7 E 40 12 34 % E
m	56787012349
~	671901234
***	1234567890123456784012345678901236548678901234567890123436789012345678901
	N

							292.		625.2	•		21 E. 4	3	m - 1	~ ~ ~	114.2	****	***	314.2
<u>د</u> ع		0.0008					6.4.4	4.4.4	21.3	62404	127.9	8 . X 6 5	127.9	9*9	572.0	20°	961.0	57%.0	7.07
SUBJECTED TO NCH-AKISYMMETRIC LUADING	0.0	6.00 F-4					530.2	536.2	4	530.2	16%.5	163.5	8.63°	0 5 6 6 F	732.0	9	732.6	7 3 2 0	919
-AX I SY PINE	~ ~	×	0044	•	002003004		424.4	414	22.3	414.9	192.5	127.9	5 % A T	127.	861.9	76.4	572.6		١
ED TO NCH	o o	E=30E6, MJ=0,3	0000	•	* * *		665.0	292.1	62°7	292.1	2112 25.9	9	21 Lo4		***	114.2	£03.2		7
	•	# STEEL - 30.0			122	Į	10701	176.8	176.6	176.A	24.5	3	218.0	i i	\$74.0	24.0			
THICK MALLED DISC SYSTEM	~ M	1 127# 0.0	20 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0				96 10				2 70				03 36				
THICK M	PAN TER	00000		\$00000	E 62	HTER	9			•	9				•				

1234547690123456769012345678901234547890123456789812345678 012345678981236547898

FIGURE III-H.21 INPUT - THICK WALLED DISC, NON-AXISYMMETRIC LOADING

HAPPONSC LCAOS (THERMAL D

		8											
			6	ð	93	Ö	*	Ą	A	3	3	Ş	Я Э
		P. GROADE	3	ž	8	200	3	=	8	2	300	3	38
		j	22.5	20.23 M	22.48	41.4	į	124	2	212	2	1	193
		m	ż	å	š	\$	š	ď	ě	j	S-4X749	Ġ	ð
	E	¥	7	•	2.2	**	*			R		病的	*
	PO 3%	*0 306+58+**	E C	Ai Co	3	200	23	68	60	20	25	03	60
GAO		4	30	¥	*	4	*	3	3	3	3		
ب		3.6	\$6 4 W	2002	1300	12.24	30113	20000	750et T	1000 E	13 3 0 0 0 C	18 1 × 2	300000
			4.0	30	₹°0		3	3	*	.0	2 *0	¥:0	9.0
	-	N	•	•	_	<u> </u>	•	#	•	•	•	21	*
	80 ERT	60		_	æ		=	N	Ñ	~	Ä	걸	Ä
	Q.	Ē	8	E 03		3	3	20	3	63		5	3
		9. 7071	200	2000		200	7	3	3	Ş		3	200
		ģ	35	176	•	E.	S	E	200	2	•	S	300
			ó	ě	9	ě	ď	ð	•	ó	•	ě	ŏ
	POINT		4	~	9	8	4	•	~	•	29	-	45
	Ö												•
Ų	_												
PONEC.	_												
HARROWSC	_	~	ı										
OF HARROWSC	_	~	ı										
BEN OF HARMONSC	_	Pal	ı										
STATES OF HARROWSC	_	Pa	ı										
3	REGUESTS	~	ı										
3	REGUESTS	~											
3	REGUESTS	~											
3	REGUESTS	~	•										
3	REGUESTS	~	•										
3	REGUESTS	~											
3	REGUESTS	~											
3	REGUESTS	~											
STREET OF HUMBER OF LOADING BU	DADING POTETS REQUESTS	2											
STREET OF HUMBER OF LOADING BU	DADING POTETS REQUESTS	2											
STREET OF HUMBER OF LOADING BU	DADING POTETS REQUESTS	2											
STREET OF HUMBER OF LOADING BU	REGUESTS	2	,,,										

PIGURE III-H.22 ASYMMETRIC LOAD DATA OUTFUT, THICK WALLED DISC

RESELVE OF RADORIC ARRIVER

ELEMENT MARKOMIC CCEFFICIENT FOURIER COEFFICIENT NO 9.0 0.353524E 03 1 0.20000E 31 0.349465E 03

FIGURE III-H.23 HARMONIC LOAD CUTFUT, THICK WALLED DISC

TO THE PROPERTY OF THE PARTY OF

. 4 ./ support (2)

... ... SECTION C R O S S (STRESSES EVALUATED AT THE ELEMENT CENTROLD) ASYPPETRIC 7 X F F 0 R STRESSES

	(2- 10€ TA !	•	(?- We ?a)	9	17. No. 14.	9
	SHEAR STAESSES (R=THETA)	• •			新闻 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6	0
ELEMENT CAID POINTS 2 3 4	E 4	•	# *	3	* T	•
3	**	8	•		19	8
ELEMENT 2 3	e na	0.7499750£ 04	(RZ)	•••	17 W	0.740937586 06
ELEMENT TYPE.	CIRCUPFERENTIAL (THETA-THETA)	9-16697736E 06	CIRCUMFRENTIAL ENETA-THETA)	9.1950M54E &	Circum erentia. Une ta-theta	6. 609968.25E 04
ALMOER 1		8		8		8
ELEMENT ALMBER	AXIAL (22)	0. 1560ms4E C6	AKSAL 1223	6. 1£908656E 96	PRIPE (22)	-6. 300142 SeE 65
LOAD CONCITION NUMBER	APPARENT GLENENT STRESSES STRESS AADIAL POINT (RA)	G.13965919E C6	ELEMENT APPLIED STRESSES STRESS RADIAL POENT (AR)	0.15908656E 06	HET ELEMENT STRESSES STRESS RABIAL POINT (RR)	-0.193673795 05
	STRESS POINT	eni	element Stres Pornt	-	MET ELEI STRESS POEMT	~

FIGURE III-H. 24 a HARMONIC STRESSES FOR ELEVENT NO. (1) , HARMONIC (4 - 0), THICK WALLED DISC

SECTION RING CROSS (STRESSES EVALUATED AT THE ELEMENT CENTROLD) ASYFFETRIC TRIANGULAR T E f 0 # STRESSES

1

		Ś				8
	\$ (2~14£7a)	0-30051470E OF	\$ (2-146.1A)	0.0	\$ {Z~B4£TA}	A. 38851.78E O.
	₩ ₩	*	8 8		w ••	£
ELEWENT GRED POINTS 2 3 4	STEPSTES EST (A-THETA)	-4.25 TP18180E 04	SERRES STREETS	•	SHEAR STAMSSERS	-0.25779156E CA
8	4.0	8	01		•	E 03
ELENENT GALO	(82)	0-13904594E 03	(82)	0	(82)	0.139045E 05
ELEMENT TYPE	CIRCUMFERENTIAL (TWETA-THETA)	0-11695213E 06	CIRCUMFORBITIAL (TRETA-)	0, 1574 B6 0E 04	Circumprential (Theta-Theta)	-0-465317906 05
ELENENT NAMBER	AXEAL (22)	0.1522049AE 06	AX8AE 622)	0.1574#3#8E G	AKUAL (225	-0,5278t375E C4
LCAD COMDITION NUMBER	APPARENT ELEMENT STRESSES STRESS RADIAL POINT (RR)	0.12593919E 06	ELEMENT APPLIED STRESSES STRESS RADIAL POINT (RR)	0.157483886 06	NET ELEMENT STRESSES STRESS RADIAL POINT (RR)	-0.315444866 95
	APPAREN STRESS POINT	-	elenent Stress Point	-	NET ELE STRESS POINT	~

FIGURE III-H.24 b FARMONIC STRESSES FOR ELEMENT NO. (1), HARMONIC (48 = +2), THICK WALLED DISC

DISPLACEMENTS

>	-0.5726276-03 -0.2818995-01 -0.2771096-01 -0.1439976-01
>	00000 0000
ق	-0.322093F-02 -0.174501E-02 0.377694E-02 0.304158E-02
GAIO POINT	ન્ય ૧ ૫ ભ જ છ
THETA	00000

PIGURE III-H.25 & NODAL CIRCLE DISPLACEMENTS AT 8 - 0°, THICK WALLED DISC

DISPLACEMENTS

3	-0.1427235-63 -0.2617725-01 -0.261725-01 -0.141725-01
>	0.116087E-02 0.656439E-03 0.690500E-03 0.856000E-03
ə	-0.13%52£-02 -0.976223E-03 6.46223E-02 0.445186E-02
GRID POINT	વ્યાપક ્ષા હ ે ક્ષ
THETA	3 4 4 4 8 5 6 6 6 6

PIGURE III-H.25 b NODAL CIRCLE DISPLACEMENTS AT 0 = 60°, THICK WALLED DISC

HET STRESSES FOR THE TREMBULAR RING BLENGHE

(STRESSES EVALUATED AT ELEMENT CONTROLD)

\$166.0 \$-\$66.0 \$-\$6.00 \$-\$16.40
SMGAR 6-6-27379398 94-6-273793988 04-6-273793988 04-6-273793988 04-6-2737979798 04-6-27379798 04-6-27379798 04-6-27379798 04-6-27379798 04-6-27379798 04-6-27379798 04-6-27379798 04-6-273797998 04-6-273797979999999999999999999999999999999
\$16.28 \$-1.693978 \$-2.693978 \$-2.6932176
196 196
CIRCUMPENTS A. -6.62899988 94 -6.86418176 94 -6.8628958 03 -6.8628958 04 -6.9641878 04 -6.9641878 04 -6.9641878 04 -6.9641878 04 -6.9641878 04
RADIAL -0. 55922-646 -0. 35139-646 -0. 35139-646 -0. 3513-646 -0. 5593-646 -0. 5593-646 -0. 5593-646 -0. 5593-646 -0. 5593-646 -0. 5593-646 -0. 5593-646 -0. 5593-646 -0. 5593-646 -0. 5593-646 -0. 5593-646 -0. 5593-646 -0. 5593-646
CIRCUMFE- MENTIAL 0 90 0 0 90 120 120 120 210 210 210 300 330
\$ 8 2 8 2 8 3 8 4 8 5 8 6 8 7 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8

FIGURE '11-H.26 STRESSES IN ELEMENT NO. (1), THICK WALLED DISC

THE RESIDENCE CONTRACTOR OF MEMORY PROPERTY AND ADMINISTRATION OF THE PERSON OF THE PE

LIST OF REFERENCES

- 1. Mallett, R.H., and Jordan, S., "MAGIC: An Automated General Purpose System for Structural Analysis: Volume I. Engineer's Manual", AFFDL-TR-68-56, Volume I, Air Force Flight Dynamics Laboratory, Wright-Patterson AFB, Ohio, January 1969.
- 2. Jordan, S., Mallett, R.H., and Maddux, G.E., "MAGIC: An Automated General Purpose System for Structural Analysis: Volume II. User's Manual", AFFDL-TR-68-56, Volume II, Air Force Dynamics Laboratory, Wright-Patterson AFB, Ohio, July, 1969.
- 3. DeSantis, D., "MAGIC: An Automated General Purpose System for Structural Analysis: Volume III. Programmer's Manual", AFFDL-TR-68-56, Volume III, Air Force Flight Dynamics Laboratory, Wright-Patterson AFB, Ohio, January 1969.
- 4. Jordan, S., "MAGIC II: An Automated General Purpose System for Structural Analysis: Volume I. Engineer's Manual (Addendum)", AFFDL-TR-71-1, Volume I, Air Force Dynamics Laboratory, Wright-Patterson AFB, Ohio, May 1971.
- 5. Jordan, S., and Gallo, M., "MAGIC II: An Automated General Purpose System for Structural Analysis: Volume II. User's Manual", AFFDL-TR-71-1, Volume II, Air Force Flight Dynamics Laboratory, Wright-Patterson AFB, Ohio, May 1971.
- 6. Gallo, A.M., "MAGIC II: An Automated General Purpose System for Structural Analysis: Volume III. Programmozou Manual", AFFDL-TR-71-1, Volume III, Air Force Flight Dynamics Laboratory, Wright-Patterson AFB, Ohio, May 1971.
- 7. Pickard, J., "FORMAT-FORTRAN Matrix Abstraction Technique: Volume 5, Supplement 1 Engineering User and Technical Report Extended", AFFDL-TR-66-207, June 1970.
- 8. Gallo, A.M., "MAGIC III: An Automated General Purpose System for Structural Analysis: Volume III. Programmer's Manual", AFFDL-TR-72-, Air Force Flight Dynamics Laboratory, Wright-Patterson AFB, Ohio, April 1972.
- 9. Batt, J.R. and Jordan, S., "MAGIC III: An Automated General Purpose System for Structural Analysis: Volume I. Engineer's Manual," AFFDL-TR-72-42, June, 1972.

- Yo Pass - W. S. F.

REFERENCES (Continued)

- 10. Melosh, R. J., and Bamford, R. M., 'Efficient Solution of Load-Deflection Equations,' J.A.S.C.E. (Structures Division) Paper No. 6510, pp 661-676 (1969).
- 11. Guyan, R. J., *Reduction of Stiffness and Mass Matrices, * AIAA Journal, Volume 3, No. 2, February 1965.
- 12. Rommel, B., *Development of a Pseudo Dynamic Matrix for Free-Free Modes and Frequencies, * Private Communication B. Rommel to S. Jordan, June 1963.
- 23. Zienkiewicz, O. C., *The Finite Element Method in Engineering Science, * McGraw Hill London, 1971.
- 14. Apps, K., Smith, G.C.C., Hughes, J.T., "Rational Reduction of Large-Scale Eigenvalue Problems", AIAA Journal, Volume 10, Number 7, July, 1972.

APPENDIX A USER MANUAL UPDATES

The following presents updated User instructions to the MAGIC User's Manual. The updates are referenced to the MAGIC II User's Manual (Reference 5) by page number.

- 1. Page 36 The EPRINT abstraction instruction does not have dots around it. It should read EPRINT(a,b,c)D.
- 2. Page 37 The following additional options are available for the .ASSEM. structural abstraction instruction:
 - d = 1 , to assemble the reduced element stiffness
 matrices
 - d = 2, to assemble the reduced element mass matrices
 - d = 3 , to assemble the reduced element incremental
 matrices
 - d = 4 , to assemble the reduced element applied load matrices

where for d = 1, 2 and 3 [C] will have the order (N x N) where N = NS x S = (the number of retained degrees of freedom). If d = 4, then C will have the order (N x 1).

$$c = \begin{bmatrix} c_{11} & c_{12} \\ c_{21} & c_{22} \end{bmatrix} \quad \text{or} \quad c = \begin{bmatrix} c_1 \\ c_2 \end{bmatrix}$$

- 3. Page 37 The GPRINT abstraction instruction does not have dots around it. It should read GPRINT(a,b,c,Cl.C2.C3.etc)F,G.
- 4. Page 38 Explanation of Matrix E.
 - E. This matrix is optional. It may be suppressed if input matrix F is in unreduced form, i.e., contains all system degrees of freedom. If matrix F is reduced, then E must be a transformation matrix (generated from OMP5) used to unreduce F for printing. If a = 3, then this matrix must be present if the eigenvector matrix is reduced, which is usually the case.

APPENDIX A (CONT)

- 5. Page 103 Item Number 4
 - 4. Number of Load Conditions (Cols. 15-16)

 The number of load conditions is equal to the number of external load conditions that are applied to the system. Note that external loads are not to be confused with element applied loading such as temperature and pressure.

If there are no external loads applied to the system, then the number of load conditions should be set to zero and no LOADS section need be input. An element applied load scalar of 1.0 will automatically be generated.

At the present time, the maximum number of external load conditions allowed is one hundred (100).

- 6. Page 103 Item Number 6
 - Number of Prescribed Displacement Condition -(Cols. 23-28)

Applied loading may be prescribed in terms of non-zero displacement values. Either one prescribed displacement condition or NL prescribed displacement conditions can be accommodated per execution, where NL is defined in item number (4) above. Therefore, the number of prescribed displacement conditions should be equal only to 1 or NL. If there are no prescribed displacement conditions, then this entry is ignored by the User.

7. Page 105 Item Number 6

This item should read as follows:

- 6. Number of prescribed displacement conditions.
- 8. Page 131 Item Number 12

This item should read as follows:

- 12. Prescribed Displacement Condition Section (Figure II-11)
- 9. Page 134 Condition Number (Cols. 7-11)

A

A B OF BOOK & PARK

The condition number is a fixed point number. In the present MAGIC System either 1 or NL prescribed displacement conditions can be accommodated per execution. NL is defined as the total number of loading conditions in a given analysis. If the User specifies NL prescribed displacement conditions then the corresponding prescribed displacement condition will be used with the appropriate external load condition. If you specify 1 prescribed displacement condition, then the same set of values will be generated NL times to be used with each external load condition.

APPENDIX A (CONT.)

- 10. Page 136 Item Number 5
 - 5. The number of prescribed displacement conditions must be specified on the System Control Information Data Form (Figure II-3). This value is equal to 1 or NL, where NL is defined to be the number of external load conditions.
- 11. Page 138

 Last Paragraph should read as follows:

 The first entry on the External Grid Point Loads
 Form is prelabeled LOADS and requires no information
 from the User. If there are no External Loads
 acting on the system, then the User does not have
 to input a LOADS section. The MAGIC system will
 automatically generate one zero load condition
 with an element applied load scalar of 1.0 for
 the User.
- 12. Page 138 Delete Item Number 3 under Condition Number.
- 13. Page 140 Item Number 1 under REMEMBER heading should read:
 - 1. The External Grid Point Loads Section may be omitted if there is no external grid point loads acting on the structure. Enter a zero on the System Control Information Data Form (Figure II-3) if this is the case. An applied element load scalar of 1.0 will automatically be generated for the user.

APPENDIX B

MAGIC INPUT DATA FORMS

This Appendix compiles all the MAGIC structural analysis input data forms. The use of these forms is explained in detail in Reference 5 and this report. They are placed here to serve the User as "tear-outs".

EAC 1815

MEPGAT (/)

MAGIC STRUCTURAL ANALYSIS SYSTEM INPUT DATA FORMAT

TITLE INFORMATION

THIS IS THE PIRST ENTRY ON ALL REPORT FORM INPUT RUNS AND IT IS REQUIRED FOR ALL RUNS. HUMBER OF TITLE CARDS s H मिन्निक

S	<u> </u>	\$	S	5	S	\$	5	S	3
	H			H			H	H	H
200	H	H	H		H	-	H		\exists
							士	廿	士
	日	日	日	H	H	H	日	日	日
	<u> H</u>		且		<u>H</u>	出	上	且	旦
	日	H	H	H	H	H			目
	日	目	日	Ħ	H	Ħ	H	H	目
	甘	甘	1	十	Ħ	十	十十	日	目
	H	日	日	Ħ	H	日	H	H	日
		\Box	\Box	丑	日	$-\Box$	oxdot	$-\Box$	日
									H
	H	B	日.	H	H.		H	且	旦
1			日	日	日	H	H	日	日
	日	目	目	日	目	H	日	目	日
	11	廿	廿	士	廿	++	+	十	甘
	H	目	目	目	Ħ	目	日	日	目
	井	井	井	丰	井	##	井	44	丰
	H	目	H	目	口		口	口	日
	日	Ħ	Ħ	Ħ	目	Ħ	Ħ	H	日
	Ħ	干	H	Ħ	Ħ		H	H	Ħ
				H	\exists			日	6
3 4 8 8	$-\Box$		$-\Box$		$-\Box$			$-\Box$	
							\Box		H
	日	且	上	耳	且	山	土	山	耳
"•	日	日	H	H	H	日	H	目	日
	 	Ħ	Ħ	Ħ	H	H	片	月	H
	甘	甘	甘	甘	甘	甘	甘	甘	H
	日	日	日	目	目	日	日	日	日
12346678861234667880		##	井	一十	#	日	-[-		
				日	日		日		日
	日	日	且	且	且	E	且	且	日
		日	日	日	日	日	日	日	日
	日	H	日	日	日	日	H	日	日
لللب									لــــــــــــــــــــــــــــــــــــــ

397

The second secon

BAC 1816-1

123458

MAGIC STRUCTURAL AMALYSIS SYSTEM INPUT DATA FORMAT

MATERIAL TAPE INPUT

		3															
È	13.54					(/)		(/)	(/)	23	1/1	3	5	473	(/)	5	(/)
MASS DERBITY	30 *				2												
5	7 8			MODULE	*0							E					
	8			Ş	*												
Namber of Plastic Pts.	736			REGETY	4 8												
Automative Number of Mar'l, Pits,	•=			-	B-F	5	Ę								_		
Stant Mark	8		١,		WHO	<u> </u>	<u>*</u>	ě	, —	T-		Γ-			·		
frint Mer?].				THENGAL EXPANSION	90												
Colog Managedial Marine Trains	67			, <u></u>													
Simely bbA	3			8₹	. 6.7							上					
Pleatie Orthotragic	*			*	31.												
Simely Sigerage!	*			uequ	Device.	¥	ř	ř									
Crthotropio	3			8	12						_						
(approprie	4			RATIO	8 8 6												
	₹3 8				~												
				Ş													
8			ן ו	vep	WHO mm	7,00	<u>ــــ</u> ح		L	L			<u>L</u> :			L J	
2	2 3				- 2												
E S	- 0			MODUL	8 0			-									
MATERIAL IDENTIFICATION				28	7 8												
TER!	61,			YOUNGE	4 5 6												
§ §	3.4.5		Į	MP41	NM Seric												
	1.2		l			Š.	<u>ئ</u> ا	ن و ا		}]			ŀ	
	8 9 6		3	345	70%												
Cack Cods	- 1		1	TEMPERATURE	,												
₹ €	\$		MATERIAL PROPERTIES TABLE		9					Ĭ							
MATERIAL	33									}						j	
Notwork 3 to	6		Y HE														
Steupefi Seirouid	, 1		Ĭ														

398

i.

MAGIC STRUCTURAL AMALYSIS SYSTEM INPUT DATA FORMAT

MATERIAL PROPERTIES TABLE (continued)

		141	(/;	()	(;)	~	5	. / 3	()	?	(;)	113	()	5	S	:
		-	*	J	-	S	J	40	•	<u> </u>	مين	**	~	_	_	~
	M	7														
1 3	-	1		•												
LAUDON YTTGEBIR		_														
18	90	_	7													
) 2		_	_		-		_								_	
ح ا		-	_													
1 8				_			-							_		
lä		-+					-	-			-		-		_	
į		-+					-						\vdash			
1		-+		-	H					-	-					
-			٦,	· R												لسسا
		<u>, </u>	F	e e												
			_													
	-				-		-		-					-		
į ĝ		—		-			-							-	_	
1 2			-							 	-					
0		┷			-	┝┉┥	┝╼┥	-			 				-	
F	- 3	∤-			┝━┥	 -		\vdash		 			-		 	
COEF. CF		∤-			 			-		 					-	
1	. 8		-		-		-	-				-	 		_	
- 1 - 3		∤-			_			_	-	_	-		-			
i P	7	-+			_	_					 			_	-	
<u> </u>	النا							لسنا		ليسا			لسسا			
		ž	Ĺ	Ţ,		,										
- 1	7-1-1-1	_													-	
		L											نـــــن			
POSSONE RATIOS	40															
1 2												ĺ				
1 8		-														
		J.	_				_									
İŞ	3				-							-				
1 -	na.							_							-	-
L	127	- _W -L.	ل		لسسا	لسا		لـــا		لسيا	لسيا		لببيبا			لسيا
		7	3	2												
	1 64				_		_	_						,	_	
1						_					\vdash					
1 2	·											-				
1 8	70	-			-											
9	9		_						_			-				
	9							-								
THOOM MONTH					ļ	 	 	 		ш	 			 		
							بنا									
	9		-4				\vdash				\vdash					—
•	NA							-			-					
L		بلي.	ل		ـــــا	L	ـــا	لسبا		لــــا	لـــا	لـــا	لسا	لسا		لبيا
		×	-3	ž												
	1 4			1		1			1	1		1			ļ	
- }	1 =			- 1		ļ		-								
l w				1						į	Н					
9	唱								ļ		 -			-		
1 5	;					1			ļ			ł			1	
				- 1			į									
. 1	व			1		ł		┝─┤			 			\vdash		
SOI LA BORDAL						l		-								
F				- 1		1				į	 					
1				- 1				 			 			 		
ـــا	157				لـــــا	i	i	<u> </u>	l	į	L	l		لـــا	l	
1																
-																

399

EAC 1617

MAGIC STRUCTURAL ANALYSIS SYSTEM INFUT DATA FORMAT

* "2		2	Ξ		5	<u>\$</u>	Ξ	Ξ	Ξ	<u> </u>	2	2	2	2	S	()	2	S	S	S	S	S	
7	1	_	1	1	1	 	 	 	 	 	 -	├	╂	 	├	-		} —	├	-	-	-	Į
			L	Γ					1	1	1-		1-		 		├	╂~~	 	╂	 	╂	4
فسأ	4	-		Ţ											1		_	†-	 	1	†	 	1
S. C. C. C. C. C. C. C. C. C. C. C. C. C.	Ļ	!	↓_	1_	1_	1_									T-			T	1-	1-	†	†~	į
<u> -</u> 2	} -	 	 	╄	 	 	ļ	!														Ĺ	3
	}	 	┪	╂	╂┈	┿	 -	 	-	ļ	ļ	<u> </u>	 										I
	}	╅		 	╂	+-		 -	ļ	ł		 	!	-	<u> </u>	-		<u> </u>	L	<u> </u>	<u></u>		I
	-	 	 -	1-	╂	 	 	-	 	-			 	├						-	 	 _	1
9	1	1	†	1-		 	 	 	 	-				ļú.	-	_		 	<u> </u>	<u> </u>	<u> </u>	 	Ĵ
F_		N		_	1_	J	i		1									1	1	1	Ĭ		١
STIC PROPERTIES	-				L												-	-	┝	 	┢	┼~	ł
	1_	<u> </u>	L.,	_	!	_	<u></u>										_			1-	 	 	t
	}		}	ļ	₽-	↓	 	<u> </u>	<u> </u>														Ì
W	-		├	! -	 	╄	} -		 -	 	_		<u></u>										I
2 7		-	-		!	ŧ	} ~~	 	-					-				_	 _	!		<u> </u>	Į
E						1							-	-				-	 -	}	 -	-	ł
0																-			-		-		t
È 1	!			<u> </u>	.	-											-						t
S res	-	-		 	 	}	 .		_														Ĩ
PLASTIC PROPERTIES TABLE		>		!		1																	Г
		-		-	 	}	-		-	-	-			-	_			-	_	_			Ļ
												-			-					-		-	ŀ
29																	_	\vdash \dashv			-	-	ŀ
-	-	-	Ь.,	.																			ŀ
			-		 -	 	-			-													r
					┣		\vdash																Ĺ
					-	-	Н	\vdash					-					_		—			L
•											-		-					-			-	-	ŀ
•																7							ŀ
		×													_	_	-		-	-			۲
	-		-	-		-			-														Ĺ
					-							{			4								L
• • •																-+		}					-
- 9		_																	\neg				-
1	-					_				_									-				٢
					-	-																	
ē		_	-	-		Н	-											_					
								_	-		-4										-4		
100										_		_		-1		-+		- -∤					-
	1	M	4						7		7	_	_	-	-	7		-+			}		-
		.=↓	-4				_		_	_	_												
13	_									~-	-4.	ļ						\Box					_
<u>ng</u>							-			-+	+	-+	-+	-+	-+	+		-4					_
		I	コ							+	_	7		-+	-+	+	7	-+		-+	۳,	4	_
Fa	[\Box	I				口								-†	7	7	十	-+	-+	-	-	
7			∤		_													_†		-+	- i	-+	-
1 4		+	-+					+			4		4	1	ユ		J	1			二		_
			-	-+	-	+	}			∤	-+	- }	-+			+	-		4	_[_[J	
-							_†	+	†	7	7	+	+	-+	┯	+	}	-+	-+		4	4	~
	T	8				-	T		~	7	-+	7		-+	-+	+	-+	+	-	-+	-	-+	_
	∤	-	극	-+			4		_							J.			I	_[
	ŀ	{	ŀ	{	Ì		-		-	-	-	_[L		Ţ	J	T	J	T	J	7		
w ad	t	-	ŀ	\dashv	ł		ŀ	{	ŀ	-	ŀ	{	-		Į.	-	Ļ	_					
3 3	t		r	-	ŀ	-	ł		ŀ		H	\dashv	ŀ		-	-1	ŀ	-	Ļ	_	Ĺ	_	
			ľ		t		t	-1	r	-	卜	닉	-	\dashv	}-	~-	ŀ	-	ŀ	_	ļ.		
	Ç	_			Ţ				t		t	3	r	7	} -	{	H	-	H		ŀ	\dashv	
18676	Ļ	-	ŀ	-	- 1			_		J						J	t	7	t		r	-	
	-		ŀ	-	ŀ		ŀ		-		-	-1	-	4		J			Ľ				
	Ľ		t		ł		t	_	-		1	4	ŀ	4	ŀ	-4	Ļ	_	[
			-		-		78			_	· -							3			197	₽.	

MAGIC STRUCTURAL ANALYSIS SYSTEM INPUT DATA FORMAT

SYSTEM CONTROL INFORMATION

		ENTER APPROPRIATE NUMBER, RIGHT ADJUSTED, IN BOX OPPOSITE APPLICABLE REQUESTS	S Y S T E M (/)
1.	Number of	System Grid Points	123456
2.	Number of	Input Grid Points	7 8 9 W 11 12
3.	Number of	Degrees of Freedom/Grid Point	13 14
Ц.	Number of	Load Conditions	15 16
5.	Number of	Initially Displaced Grid Points	17 18 19 20 21 22
6.	Number of	Prescribed Displaced Grid Points	23 24 25 26 27 28
7.	Number of Systems	Grid Point Axes Transformation	29 30
8.	Number of	Elements	31 32 33 34 35 36
9.	Number of Material 1	Requests and/or Revisions of Tape.	37 38
10.	Number of Condition	Input Boundary Points	39 40 41 42 43 44
11.	To For Str	ructure (With Decimal Point)	()
		401	45 46 47 48 49 50 51 52

BAC 1619

the state of the s

MAGIC STRUCTURAL ANALYSIS SYSTEM INPUT DATA FORMAT

CALCULATION CONTROL

-	-		-	-
C	A	L	С	(/)
1	2	3	4	5

PLACE 'X' IN BOX OPPOSITE DESIRED OPERATIONS

1	. Revise Material Tape		
2	. Inverse Solution		
3.	Choleski Decomposition		
4.	Linear Function Minimization Solution		
5.	Nonlinear Function Minimization Solution	on	
6.	Plastic Analysis		5
7.	Grid Point Axes Transformation		-
₽.	Stress Calculations		
9.	Reactions		
10.	Structure Plot		
11.	Dynamics Analysis	100	10
		402	11

MAGIC STRUCTURAL ANALYSIS SYSTEM INPUT DATA FORMAT

PRINT OPTIONS

P R I N T (/)

PLACE 'X' IN BOX OPPOSITE
DESIRED PRINT

1.	Assembly - Stiffness	
2.	inverse - Stiffness	
3.	Triangularized — Stiffness	3
4.	Displacements	
5.	Intermediate Function Minimization	[(/)

BAC 1621 Rev. 571

MAGIC STRUCTURAL ANALYSIS SYSTEM INPUT DATA FORMAT

EIGRNVALUE INFORMATION

	FOR USE IN ALL EIGENVALUE PROBLEMS		-	DYNAM (/)
1.	Number of Ei (Less Than o	genvalues Requested r Equal to 20)		
2.	Convergence (Default Opt	Criteria (Floating Point) ion - 0.001)	3 7 8 8 7 8	9 10 11 12 13 14
3.		er of Iterations ion - 500 Iterations)		15 16 17
4.	Iteration Iteration	ion Print Print ON = 1 Print OFF = 0 ption - Print OFF)		
5.	First Normal (Default Opt	izing Element for Print ion - No First Normalizati	on)	19 20 21 22
6.		lizing Element for Print ion - No Second Normalizat	ion)	23 . 24 25 26
7.	Column Ite Row Iterat	Guess Vector Iteration Staration Start = 0 ion Start = 1 ption - Column Iteration S	Start)	(/)

MAGIC STRUCTURAL ANALYSIS SYSTEM INPUT DATA PORMAT

COORD (/)

GRIDPOINT COORDINATES

_																D		_	R	-		C		r	1	<u> </u>)	N		}]
S			G	rid Nu	Po		ţ				2	X ·	_	R							Y	, <u>.</u>	- 4	B -							Z	-	Z				
5		,	8	ě	1	1	2	1	4		(1 7		. 1	2	1	2	3	4	\$		7		•	30	1	2	3	4	5	•	7	i	9	4	1 :	2
L	8		L	L	L	L	Ļ	Ļ	L	L	Ļ	Ļ	Ļ	L	L	L	L	L	L	L	L	L	L,	L				Ц		\downarrow	1	1	1	4	1	1	11
L	888 888 888 888 888 888 888 888 888 88		L	L	L	Ļ	L	L	L	Ļ	Ļ	Ļ	L	Ļ	L	L	Ļ.	L	L	L	L	L	L	L,	Ļ	Ц	Ц	Ц	4	. .	4	1	4	4	1	\downarrow	1 11
	***		L	L	L	Ĺ	L	Ļ	L	Ļ.	L	Ļ	Ļ	L	L	L	L	L	L	L	L		_		Ц	Ц	Ц	Ц	_	1	1	1	1	4	1	1	۱۱۰ لٍـ
L	*		L	Ļ.	L	L	_	L	L	L	1	L	L	L	L	L	L	L	L	L	L		L	L			Ц	Ц	4	\downarrow	ļ	1	1	4	1	1	1 (1)
	*		_	_	L	L	L	L	L	L	L	L	L	L	L	L	L	Ĺ.,	L	L	L		L							1	1	1	1	_	1	Ļ	10
L	**************************************		L	L	L	L	_	L	L	L	1	Ļ	L	Ļ	L	L	Ļ	L	L	L	L	L	L,	L	Ц	Ц	Ц	Ц		1	1	1	1	1	1	1	10
L	***		L	L	L	Ļ	L	L	L	L	Ļ	Ļ	L	L	L	L	Ļ	L	<u> </u>	L	L	Ц	L	L	Ц	Ц	Ц	Ц	4	1	1	1	1	1	1	1	(1)
Ц	***	Ц	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	<u> </u> _	L	L	Ц	L.	Ļ	Ц	Ц	Ц	Ц	4	1	1	1	1	4	1	1	(7)
L			Ļ	L	L	L	Ļ	L	_	L	Ļ	Ļ	L	L	L	L	L	L	L	L	Ļ		L	L					4	1	1	1	1	4	1	1	47
L	*		L	Ļ	L	L	L	L	L	L	L	L	L	L	Ļ	L	L	L	L	L		L	L	Ц			Ц		1	\downarrow	1	1	1	1	1	1	111
	*		Ц		L	L	L	L	L	L	L	L	L	L		L	L	L	L	L			L					Ц	_	1	1	1	1	4	1	1	100
L				L	L	L	L	L	L	L	L	Ļ	Į.	L,		L	L	L	L	L	Ĭ	Ц		Ц					4	1	1	1	1	\downarrow	1	\perp] (/)
Ц	**		Ц	Ļ	L	<u> </u> _	L	L	L	L	Ļ	Ļ	L	L	L	L	L	L	L	L	L	Ц	Ц	Ц					4	1	1	1	1	1	1	ļ	100
L			_	L	Ļ	L	L	L	L	_	L	Ļ	L	L	L	L	L	L	_			Ц							4	1	ļ	1	╀	1	1	ļ	100
	***			_	ļ.	L	L	L	L	L	L	Ļ	L	ļ.,	L		L	L	L	Ц	Ц	Ц	Ц				Ц	4	4	1	1	1	1	1	1	ļ	1/1
	***		Ц	L	L	L	L	L,	L	L	L	Į.	L	L	L	_	L	L	L		L		Ц					Ĵ	1	1	J.	1	1	1	1	1	(/)
Ц	8	4		_	Ļ	ļ.,	L	L.	L	L	L	L		L	L			L	_			Ц							1	1	ļ	1	1	1	1	\downarrow	100
Ц		_	Ц		L		L	L	L	L	ļ	Ļ	L	L	L	L	L		L.,		Ц			Ц				1	4	1	1	1	1	1	1	ļ	1 (/)
Н	8	_	Ц		L	L	L	L	L	L.	L	Ļ	L		Ц	Ц	Ц	L	L						Ц		_	4	4	1	1	1	\downarrow	4	╀	\downarrow	- 1/1
Ц	***		Ц		L	L	<u> </u>	L,	L	L	L	Ļ	L	L	Ц	Ļ	Ц	Ц		Ц	Ц	Ц						4	1	1	1	1	ļ	1	1	\downarrow	1 (/)
Li	×۶۱	4	Ц		L	Ц	Ц	L	L	L	L	L	L	L	Ц	Ц	Ц	Ц	Ц	Ц						_	4	4	4	\downarrow	1	1	ļ	4	1	\downarrow	1 (/)
	**	_	Ц	L	L	L	L	L	L	L	L	L	L,	L	Ц		Ц	L	Ц	Ц		Ц			_	_		4	4	1	ļ	1	1	1	1	\downarrow	1 (/)
	***	_	Ц		L	L	Ц	L	L	L	L	L	L	L	Ц	Ц	Ц	Ц		Ц	٠				_	4	_	4	4	1	ļ	1	Ļ	1	1	\downarrow	1 (/)
Ц	**	4	Ц		L	Ц	Ц	Ц	L	L	L	L	L	L	Ц		Ц	Ц	Ц	Ц	Ц			Ц	Ц	4	4	4	1	1	1	1	1	Ĵ.	1	\downarrow	1/1
Ц	(A)	4	Ц		L	Ц	Ц	L		L	L	L	L	L	Ц	Ц	Ц	Ц		Ц					┙	_	4	_	1	1	1	ļ.	ļ	1	1	L	(/)
Ц	*	4	Ų		L	Ц	Ц	Ц	L	L	١	L	L		Ц		Ц	Ц		Ц					_	_	4	1	1	1	ļ	Ļ	ļ	1	ļ	Ļ	1/1
Ц		_				Ц	Ш	Ц	L	L	L	L	L		Ц			Ц							_	_	1	_	1	1	Į.	1	Į.	1	1	L	(/)
Ц	*	_			_	Ц	Ц	Ц	L	L	L	L		Ц	Ц					Ц					_	_	_[_	1	1	1	ļ	Ļ	1	1	L	1 (/)
										L	L																1	1	1	L	L	L	L		L	L	100

if coordinate information must be continued on second shoot, your MUST delate Coord, Label Card from second cheet.

MAGIC STRUCTURAL ANALYSIS SYSTEM INPUT DATA FORMAT

1 2 3 4 5 6 PRE 8 8 (/)

GRID POINT PRESSURES

1 2 3 4 8 4 MODAL

Lands to the confidence of the

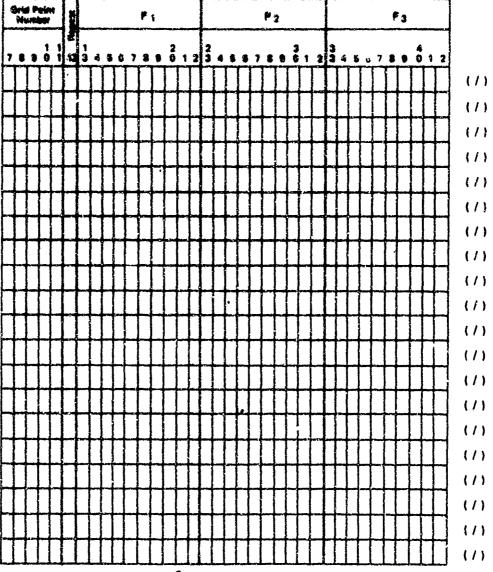
								f		A	E	8		3	U	A	E	3									
Γ				P 1	1									Pa	!			Γ					P	3			
1						20			2							3		5							4		
-	۲	-	 	÷		-	-	ŕ	2	-	-	H	-	÷		٠	-	۲	Н	7	-	_	-	•	-	Н	۲
							L																				

G	rk Nv	A	oin 201	·	Paper					*****	p.	1		*****	-			6744			P 2	}	/ ************************************	ر دونونونونونونونونونونونونونونونونونونون							ş	3				
7	8	9	9	1		13	4	5		7		•	2	1	2	23	•	6	•	7		•	3 0	1	2	717	4	•	•	7	8	9	40	ş	2	
																					3															(/)
\prod																																				(/)
																																				(/)
	_					L	L	L	L	_			L	_		L			Ц							Ц					Ц					(/)
Ц			L			L	L		L	L	L		L			L			Ц			Ц				Ц		4	4		Ц					4/)
-		_	Ļ	L	L	_	L	ļ.	_	L	L	L	L	L		L		L				Ц				Ц	_	4	4				L	Ц		(/)
\vdash	-		H	Н	L	L	L	-	L	L	-	_	L		Н	_	_	L	H	Н		H	-			Н	_	-	4	_	Н	ļ.	L	H	L	(/)
H			L	H	-	-	-	L	-	L	-	ļ	L	L	L	┞	_	L	H	Ц		_				Н	_	4	-		Н	-	H	Н	L	(/)
H		Н	-	H	-	\vdash	-	-	╀╌	\vdash	\vdash	-	\vdash	\vdash	_	\vdash	H	H	-	Н	-	Н				Н		-	-	-	Н	-	-	H	-	(/)
H	-	Н	-	\vdash	-	\vdash	-	H	\vdash	╁	 	-	-	H	-	┝	\vdash	\vdash	-	Н		Н				Н	+	+	┨	4	Н	-	\vdash	H	\vdash	(/) (/)
H		Π	۲	Н	-	 	1	╁	H	-	\vdash	-	-	┝	-	-	-	-				Н				H		1	7		Н	Н	-	Н	-	(/)
H					┝	┢	H	H	t	\vdash	 		\vdash	\vdash	-	<u> </u>	ļ	-		Н	-	Н				Н		1	7	-	Н	Н		Н	H	(/)
H		Γ			-	T	T	T	T	T			T			T		-								П		7	7							(/)
														Γ		-																				(/)
																		L																		(7)
																																				(/)
Ц	_		L		L		L	L		L		L				L	_	L								Ц					Ц					(/)
Ц	_	L	L	L	L	L		L	L			L	L	L	L	L		L	L	Ц		Ц				Ц			4		Ц				L	(/)
Ц					L	L	L	L	L	L		L		L					L																	(7)

106.

MAGIC STRUCTURAL ANALYSIS EYSTEM HIPUT DATA FORMAT

GRID POINT PRESSURES (continued)



MAGIC STRUCTURAL ANALYSIS SYSTEM INPUT DATA FORMAT

GRID POINT TEMPERATURES

TEMP (/)

1 2 3 4 8 6 MODAL

			oin ber		Patrick						Ţ	1			_						T	2									•	T ₃			
,	8	9	0	9	12	3	4	5	6	,		9	2	÷	2	3	4	5	6	7		8	2	1	2	3	4	5	6	7	8	9	40	1	2
		L						L	L	L		L																				L	L	L	L
	Ĭ	L					L		L	L							Ĺ							Ц								L		L	L
		L	Ц			L	L	L	L	L		L		L						Ц	L		Ц	Ц	Ц	Ц				Ц		L	L	L	L
		L					L	L	L	L				_	_	L				Ц	Ц		Ц	Ц	Ц	Ц	Ц			Ц		L	_	L	L
J		_	Ц				L	L	L	L	L									Ц				Ц		Ц						L	L	L	L
-		L			_	L	L	L	L	L	L		_		Ц			L			Ц			Ц						Ц		L	L	L	L
4		L				L	L	L	L	L	L	L	_	L			_				Ц		Ц							Ц		_	L	L	L
4	_	L	L				L	L	L	L		Ļ				L	L	Ц		Ц		Ш	Ц	Ц	Ц					Ц		L	L	L	L
4	,	L	Ц			Ц	Ļ.	L	L	L	L	L	_	L	Ц			Ц		Ц			Ц	Ц								L	L	L	L
4	-	L	L		_	Ц	_	L	L	L		_	_		Ц	Ц				Ц		L	Ц	Ц	Ц							L	L	Ļ	Ļ
4	1	L		_	L	L	L	_	L	L	Ļ	Ļ		_	_	L	_	_		Ц	Ц	L	L	Ц				_		Ц	_	_	L	L	L
4		L			L	L	_	L	L	L	Ļ	L	_		_		_					L	Ц	Ц	Ц		4			Ц		L	L	L	L
4	L	_		L	_	H	L	L	1	-	L	L	<u> </u>	L	L	L	L	L		L	_	_	L	Ц	Ц				Ц	Ц	_	L	L	L	L
4	-	L	L	L	<u> </u>	ļ.	L	L	L	L	L	ļ_	L	L	L	L	L	L		L		L.	L	Ц	Ш		Ц	4	Ц			L	_	L	-
4	L	<u> </u>	Į.	ļ.,	ļ.	L	L	L	L	L	L	L	L	L	_	L	-	L		L	<u> </u>	L	L	H			Н	_		Н		<u> </u>	L	L	L
-	ļ.,	L	L	L	_	L	L	Ļ.	L	L	L	L	L	L	_	L	L	L	Ц	L	L	_	H				Ц			Ц		L	L	L	L
-	ļ.,	Ļ	L	L	 	_	L	L	L	L	_	L	L	_	L	L	_	L	Ц	L	L	L		Н	Щ	Ц	Ц	4	_	Ц		L	L	L	L
								l								ı		Į									ÌÌ	1				ļ	ĺ		l

408 Peep ______ of _____

BARRANT IN THE THROUGH STREET

MAGIC STRUCTURAL ANALYSIS SYSTEM INPUT DATA FORMAT

GRID POINT TEMPERATURES (continued)

		Po	_		Report							1									Ţ	2									•	Γ3			
7	8	9	0	-	12	13	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	2	1	2	33	4	5	•	7	\$	9	40	1	2
]																							Į					
	Ц				Ц	Ц			L	Ŀ	L	L			L	L		L	L						Ц	Ц	ļ				Ц		L	L	L
	Ц		Ц			Ц	_	L	L	L	L		L			L						L		Ц		Ц		4			Ц		L	L	L
	Ц		Ц			4			_	L	L	L	L	Ļ		L	L	L	L		L		L			Ц	_	_			Ц	_	L	L	ļ.,
•	Ц		Ц	Ц	Ц	Ц		L	L	L		_	_	_	L	L	L	L	L	L	L		L		_	Ц	4	4			H		L	L	L
_	Н	_	Н			H	_	L	-	L	L	L	L	L		L	H	_	L	L	L	L	L	Н	Н	Ц	-	4	_		Н		L	-	L
4	Н	-	Н	Н	Н	H		H	L	L	L	L	_	L	H	_	L	L	H	L	L		_	Н	Н	Н	-	4	4	_	Н		L	L	L
_	Н	_	Н	Н	H	Н		H	-	<u> </u> _	H	H	-	-	H	-	H	H		H	H	L	H	Н		H	4	4	_	_	H		Ļ	-	┡-
-	-	_	Н	H	_	Н		-	-	┞	┞	H	-	_	\vdash	H	H	H	\vdash	-	-	-	\vdash	H		Н	-	-	H	_	Н	J	-	┝	┝
-	H	-	Н	Н	Н	Н	_	-	┝	-	\vdash	-	-		H	H	H	\vdash	H	\vdash	-	-	-	Н	Н	H	-	-		_	Н	_	┞	-	┝
-	Н		Н	Н	Н	Н	-	-	-	\vdash	1	\vdash	-	-	H	-	H	-	-	-	H	-	-	Н	Н	Н	+	1	Н	-	H	-	\vdash	\vdash	-
-	H	-	Н			Н				1	t				-	-	۲		H	Н		-		Н		Н	1	1		-		_	 	\vdash	┝
-	Г	-		Н				-	- 	Γ	T	H	1	-			-	r	-		-	-				Н	-	7	1	-	H		-	H	
~-						H	_	T	T	1	T	T	T	1			r	T	Γ			一	T			H	1					-		T	T
_																			•												Ī	-			r
_																																			

409

Page _____ of ____

BAC 1425

MAGIC STRUCTURAL ANALYSIS SYSTEM INPUT DATA FORMAT

7	67 63 0 12 3 4 3 67 0 5 0 1 2 3 4 5 6 7 6 9 6 1 2 3 4 8 6 7 6 5											S									
5 6 7 8 9 10 11 12 13 14	6 7 89 01 2 3 4 3 67 0 8 8 1 2 3 4 5 6 7 8 9 6 1 2 3 4 5 6 7																				
2 6 7 8 9 10 11 12 13 1	6 7 639 0 1 2 3 4 3 67 7 8 8 6 1 2 3 4 5 6 7 8 9 6 1 2 3 4 8																				
2 6 7 8 9 10 11 12 13 1	6 7 6 9 6 1 2 3 4 3 4 3 4 3 5 6 7 8 9 6 1 2 3 4 5 6 6 1 2 3 3 4 5 6 6 1 2 3 3 4 5 6 6 1 2 3 3 4 5 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6																				
5 6 7 8 9 10 11 12 1	6 7 63 4 1 2 3 4 5 6 7 8 8 1 2 3 4 5 6 7 8 9 6 1 2 3																				
5 6 7 8 9 10 11 12 1	6789 01234 3 67 05 81 234 56 7 5 9 61 2																				
5 6 7 8 9 10 11	6 7 63 01 2 3 4 3 67 0 5 0 1 2 3 4 5 6 7 6 9 0																				
5 6 7 8 9 10 11	6 7 6 9 6 7 6 6 9 6 7 6 9 6 9 6 9 6 9 6																				
5 6 7 8 9 10 11	6 7 6 9 6 7 6 6 9 6 7 6 9 6 9 6 9 6 9 6																				
2 6 7 9 9	6769 012343670980123456																				
2 6 7 9 9	6769 01234 367 09 01 234 56																				
2 6 7 9 9	6 7 6 8 0 1 2 2 3 4 6 8 6 7 6 7																				
2 6 7 9 9	6 7 6 8 0 1 2 2 3 4 6 8 6 7 6 7																				
5 G 7 B	6 7 6 9 0 1 2 3 4 3 6 7 8 9 0 1																				
5 G 7 B	6 7 6 9 0 1 2 3 4 3 6 7 8 9 0 1																~~~				F
5 G 7 B	6 7 63 0 1 2 5 4 3 6 7																			}	1
5 G 7 B	6 7 63 0 1 2 5 4 3 6 7																******			1	*
5 G 7 B	6 7 63 0 1 2 5 4 3 6 7												 							-	h
9	6 7 6 9 0 1 2 5 4 3						Za 344.44												-	_	H
9	6 7 639 0 1 2 5 4						 	4		-					_						口
9	6 7 6 9 0 1 2							 	L	<u> </u>	 										Ļ
9	6 7 6 9 0 1 2							-		}	-								├		┝
	6 7 6 9 0 1					}	-		W/32-W		-	-					-				-
	6 7 6 9					·															Γ
	6 7 6 5				-		-	ļ			-					_				-	_
	2 9						 	 			-	-	-								-
	49																				
4																					-
	5	-			-	<u> </u>		 													-
	8					~~~			_				-				-				۳
10	N																				
	20						ļ	 	-		-							-			-
~	64								-					_							
	80																****				
	_																				
- 1	_긁						}														_
-	-				***								-				-				-
n	-3																				
	_3										 						_				-
	200			-	***	-	-	 			-										-
~																					
~								 				<u></u>]		
	긓					~~~					_										-
_	-9																				
	3							-			-							-			
ۇ. ئا						-				-							***	······			-
N	Ë.																J		!		
>	뒥																				
	o o					-	~~~	*****	-	· ·			_	_		_				-	
	_			·								-,		-					_		-
e l	-3																				
52 1	9.8	[•						Ì							1					
	X Y Z 1 2	9 10 11 12 3 4 5 5 7 8 9 0 1 2 3 4 5 6 7	9 10 11 12 3 4 5 5 7 8 9 6 11 2 3 4 5 6 7	A 10 11 12 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7	10 11 12 3 4 5 5 1 2 3 4 5 4 7 10 10 10 10 10 10 10 10 10 10 10 10 10	a 10 11 12 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7	a 10 11 3 4 2 5 7 8 9 6 1 2 3 4 5 6 7 1 6	a in in in in in in in in in in in in in	2 2 3 4 2 8 1 1 1 2 3 4 2 8 1 1 2 3 4 2 8 4 2 8 1 1 1 2 3 4 2 8 1 1 1 1 2 3 4 2 8 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	a in in 2 3 4 5 5 7 8 9 0 1 2 3 4 5 6 7	2 2 3 4 1 1 1 1 2 3 4 2 8 1 1 1 2 3 4 2 8	a in in 2 a 4 5 6 7 8 8 6 7 8 8 6 7 8 8 6 7 8 8 6 7 8 8 6 7 8 8 6 7 8 8 8 6 7 8 8 8 6 7 8 8 8 6 7 8 8 8 8	2 3 1 1 1 2 3 4 2 8 7 2 8 2 1 1 2 3 4 2 8	x	x x x x x x x x x x x x x x x x x x x	X X X X X X X X X X X X X X X X X X X	x x x x x x x x x x x x x x x x x x x	X X X X X X X X X X X X X X X X X X X	x x x x x x x x x x x x x x x x x x x	x x x x x x x x x x x x x x x x x x x	X X X X X X X X X X X X X X X X X X X

USER MUST DELETE GRAXES LABEL CARD FROM SECOND SHEET.

MAGIC STRUCTURAL ANALYSIS SYSTEM INPUT DATA FORMAT

BOUNDARY CONDITIONS

INPUT CODE - 0 - No Displacement Altowed 1 - Unknown Displacement 2 - Known Displacement

PRE-SET MODE

[1	2	3	4	5	•
34	9	Đ	A	L	

TRA	NSLAT	IONS	RO	TATIO	NS	GEI	VERAL	IZED
U	٧	₩	Θ×	0¥	9z	9	2	3
13	14	18	16	17	18	18	20	21

LISTED INPUT

	_	Poi not	_	1	-		-						
1	4	0	1	4	13	14	18	15	17	18	19	20	21
_	ļ	Ļ		Ц									
L		L		Ц									
L	l												
	T	Γ		П									
	T	Γ		П									
ľ	T	Γ		П									
ſ	T	Γ		П									
Ī	Ť		Г	П									
ľ	T			П									
r	T	T		H					~				
Ì	t		Н	H									
r	T	T		H									
ŀ	†	1		H									
ŀ	\dagger			H								***************************************	
١	\dagger	┢	Н	1									
ŀ	\dagger	十		H									
ŀ	\dagger	1	H	H									
ŀ	+	+	H	-									
ŀ	+	-	H	H									
H	+	+	H	H									
L	4	Ļ	H	Ц									
l.	1	L		Ц									

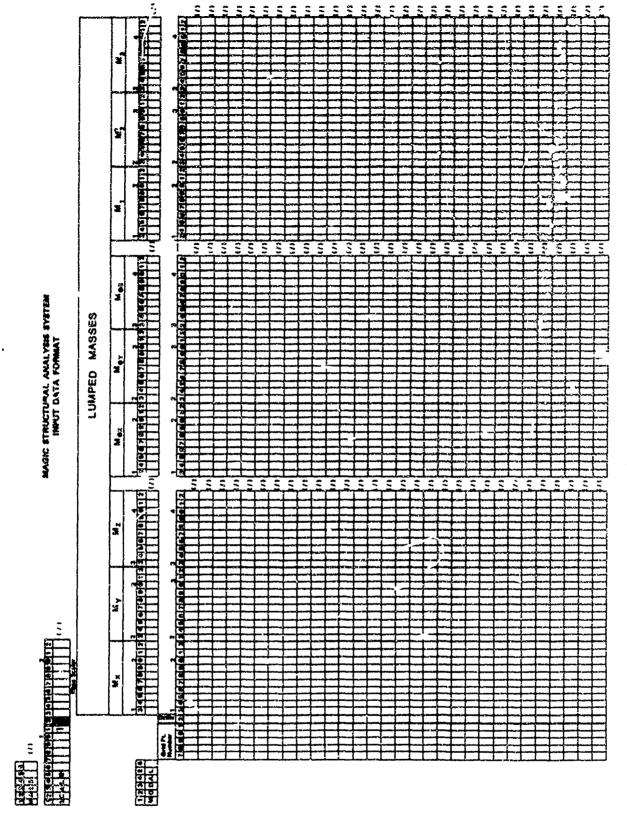
MAGIC STRUCTURAL ANALYSIS SYSTEM INPUT DATA FORMAT

BOUNDARY CONDITIONS (continued)

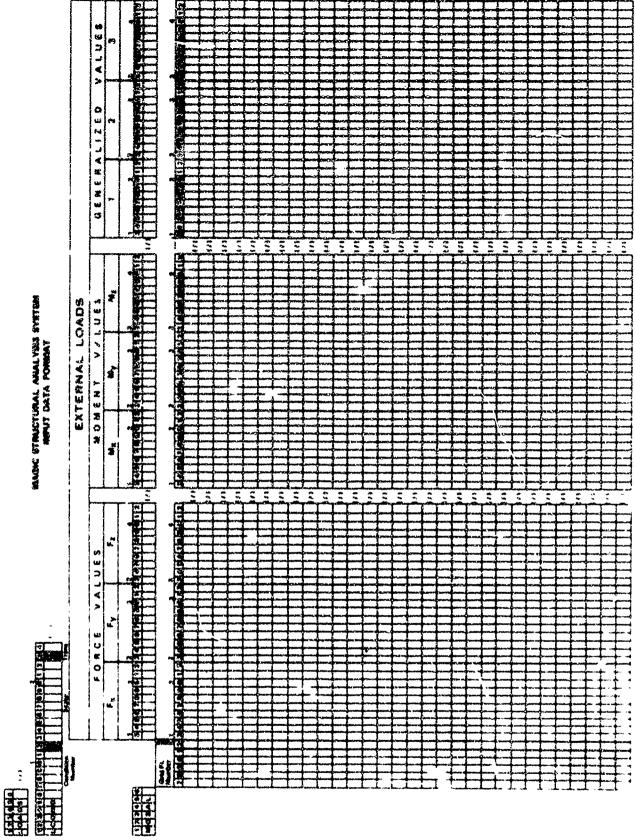
INPUT CODE 0 - No Displacement Allowed 1 - Unknown Displacement 2 - Known Displacement

LISTED INPUT

		_			¥[TRA	NSLAT	IONS	RO	TATIC	WS	GEN	ERAL	ZED
			our ber		Neces.	U	٧	w	θ×	Θγ	θŧ	i	2	3
1	8	9	3	1	2	13	14	15	16	17	15	19	30	21
	1													
		Γ	Γ											
	_	H	T		Н									
		\vdash	╁	-	Н				}					
ŀ	-	┝	╀	╁	Н									 -
Ļ	_	-	1	<u> </u> _	Н				 -	 		 -		ļ
L	_	L	\downarrow	L	Ц					ļ				ļ
L		L	L	L	Ц							<u> </u>		
			L	L			<u> </u>							
			T										}	
ľ	-	T	T	T										
ŀ	_	T	T	T			1							
ŀ	-	t	t	t			 	 	 		 	1	 -	1
t	_	╁	╁	╁	Н		 			 	 		 -	
L		╀	╀	╀	L					 			ļ	 - -
ļ	_	1	╀	1	L			<u> </u>		 	ļ	ļ		
Ļ	_	Ļ	Ļ	Ļ	L		ļ	ļ		ļ	<u> </u>	 	ļ	<u> </u>
l		L		L					<u> </u>					
			L	L]		<u> </u>	Ì		
ľ		Ţ	T	Γ										
İ	_	T	T	1	Γ									
t	-	T	t	T	1		†		1			1	 	
l		t	+	t	t	 	 		1	 	 	 	 	
	_	+	+	+	\vdash		 	 	 		 		-	
ŀ	-	╀	+	+	╀		 	 	 		 	 		
1	-	+	+	+	\vdash		 -	 	 			 	 	
ļ	•	1	+	Ļ	 -	 	 	ļ	 	ļ	 -	 	 	ļ
ļ	_	ļ	1	Ļ	1	ļ	 	ļ	 			<u> </u>		
	_	1	1	L	L				<u> </u>	<u> </u>		<u> </u>	<u> </u>	
	_													
	_	T	T	T	T									
Ì		1	T	T	T		1		T	1				
İ	_	t	†	t	1		1	 	 	\vdash		<u> </u>	1	



BAC 3604



\$110

action m. 121

ġ

----3

	S	
С		
	Π.	6
Γ.		53

MAGK STRUCTURAL AMALYSIS SYSTEM

0.5140015105151 7 ĩ . * 3 . 5 # of z sees of y 化二苯酚酚苯 化多数抗聚物 0 ski ski ski 86 • 8 2 3 4 m B) 10 6 6 1 **e**4 To vadensel madificações secres sustanti 2 5 E INPUT DATA FORMAT 918 4 * PRIMT Ä 1914 8 Slom keek R 16240 A 66071(db Ħ SATERIAL College Colle G : 3 3 6 3 6 7 2 44900 MA TERIAL AUSTON DF 88 90 ESCHARA LANGUETE

IF BLEMBYT CONTROL DATA MUST BE CONTINUED UN SECOND SHIET, URIN MUST DRIETE REM LABEL CARD FROM SECOND SHIET.

EAC 1626-1

MAGIC STRUCTURAL AMALYSIS SYSTEM INPUT DATA FORMAT

							(;)		5	??	<u>:</u>		(/)	3	;;	\$	<i>(;</i>)	(3)	3	3	3	()	3
	i	П	~]		ſ	~																	
			~=			-															-		
			•			•							~~										
		u	•		Ĭ	•																	
		-				~						-	-	-		-	_					-	
			•			•																	
			9 00		Ì	4														ļ			
		\vdash	~	-	1	7																	
			*0			~ @@																-	-
	.	1	اء		1					-	 												
	5	u	*		1	*																	
	ž		~		Ì	-	-							-					-			-	-
	F				ł	18 18																	
	W.		***********		- 1	** **				 -	├					-					-		-
	ELEMENT INPUT	ŗŤ	~		Ì	N																	
	шĭ		20		- 1	# # # # # # # # # # # # # # # # # # #				-	-		-		\vdash				 	-	 	-	
		<u> </u>	e e		- 1																		
		9	~			7 8						-				-	-				-		-
			2			•	<u></u>																
			₩			40 40	-			-	-								-	<u> </u>		 	
<u>ب</u>			40			410																	
ş			1 2		i	9 2	-	ļ	-	-								-	-	├─	-		-
			40			46																	
II.			•					 		-	-	-			-			 	 	-	-		-
Ş		U	~			^																	
Š			9			9			├	├	-	-	 	 	-	-		-	-			_	
INPUT DATA FORMAT]]	•			•																	
ž		\vdash	98			20	-		-	-	—		-	-	_	-	├		-				
=			-			-																	
			3 0			70	├	-		 -		-	-			-	-	-	 		-	-	-
		æ				•																	
			6.7			-		-		├	-		-	-	-	-	 			-			
			•			•																	
			4			4	-	-		├-	 -	 			 -	-	-	 	 	-		├	
		П	~			~																	
			~0			700		-		 	-	 -	-	-	-	-	-	-	-			-	
						6																	
						•		_							<u> </u>		lacksquare			<u> </u>			-
			9			-		-	-	-	\vdash	├	 -	-	-	-	-	-		_	-	 	
			4			9			厂											_			
			-6																				
					Honers		_		_					<u> </u>				_	_		_	-	
					<u> </u>			 	 	+	+-	+-	 	 	 	-	 	 -	-	1	 	 	+
	\$				Element	•																	
					ωZ				<u> </u>	<u> </u>	<u> </u>	<u> </u>		L				_	_	<u> </u>			<u> </u>
F	EXTERN 12365))	123856	0.44																			

41/h

BAC 1629-2

MAGIC STRUCTURAL ANALYSIS SYSTEM INPUT DATA FORMAT

ELEMENT INPUT

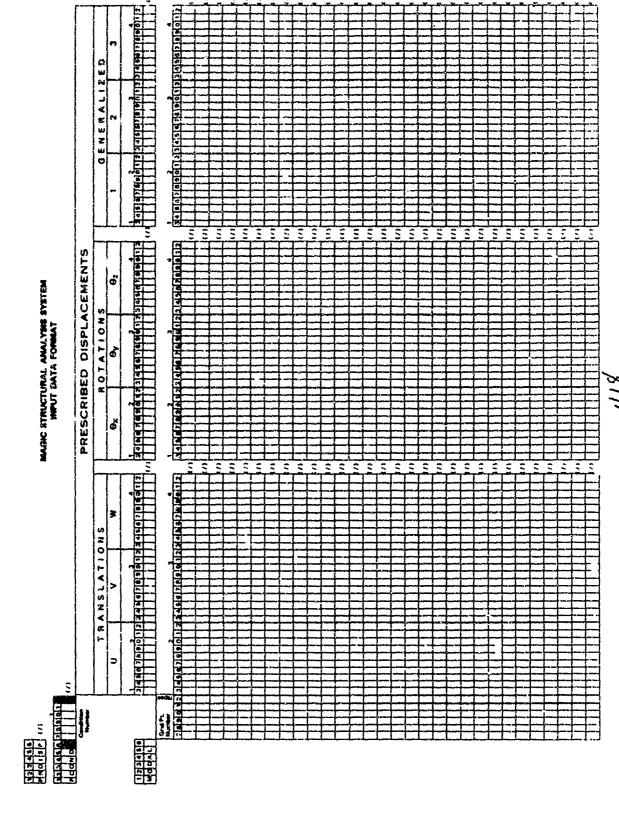
** ****

*** ***

The state of the s

			111	£ / \$	Ŝ	17	3	?		4 6 3	3	175	5	3	-	()	5	(1)	(1)	(1)	S	173
ſ		- 69	1	1	П	Г	Т	T	T	1	T-	Γ	T-	<u> </u>		<u> </u>	<u> </u>	Γ	<u> </u>	1	T	_
1	ır	#0																				
ı		P-0																				
1		•																		Ľ		
1		*																				L.
ı		^		Ļ.,				<u> </u>														
1	ĺ	•	<u> </u>		<u> </u>	↓	<u> </u>	 					<u> </u>			<u> </u>			<u> </u>			
	150	<u> </u>	<u> </u>	<u></u>	ļ	ļ		<u> </u>	<u> </u>	<u> </u>		<u> </u>					L	L	<u> </u>	L	<u> </u>	
		*	.	<u> </u>	<u> </u>	}	-	<u> </u>	┞—		 	<u> </u>	<u> </u>					 	<u> </u>			<u> </u>
L		60		<u> </u>		ļ	 			 	<u> </u>	<u> </u>		-				ļ	<u> </u>	L	<u> </u>	
	}	~	 -			 	ļ	 		 -	├	! -			-	 -		ļ		<u>ļ </u>	ļ	ļ
l	1	-	 -				 -	-			ļ		<u> </u>		-	ļ				<u> </u>	}	!
1	- 1	90	 -	 -	 	-	-	├					 	 		-					 	-
ł			<u> </u>	 		-	}	├ -			₩	ļ		-	_			}			 -	} -
1	w	7			├	┿	 	- -	-	├	┼			-							<u> </u>	├
1	- 1		├			├		 	├		 	<u> </u>		<u> </u>			┡ -	ļ			ļ	
	uñ		 		├	 	├			 							 -	├	<u> </u>	 	 	
	•	-	 	 	 	 	 			 			_	-			_	├	-		 	
ŀ		10 10	 	-		 	 	├			 					-		-	 	 -		
1		71			_	Ť	1	 -	 	 	 	 	 		 	-			}			
Ì	- 1	7 8 9 6 1	T		<u> </u>	1	1	 			1					-			 	!		-
I	į					I															\vdash	_
1											-											
Q																						
	-																					
	• •																					
	- 1	*			<u> </u>																	
-		**				ļ																
1	- 1	5			 	<u> </u>			<u> </u>					-								
1	1	40		-	<u> </u>				ļ		-										ļ	
		456789				-							-				-					<u> </u>
1	ı			-			-		 		-											-
į	ပ						ļ	_	-	-	-				_						_	
1	i			_																		 -
l	- 1							-	_	_							-				-	
			-																			
L		99																				
Г		7																				
L		-		L																		
	- {	20																				
l	- 1	•					L								_ '	4						
	m	7 &		<u> </u>]					
ı	_	6				ļ		ļ			 _											
ł	Ì	.				 	ļ	 	 		-											
1	1	4		 	Ь	 -		 					<u> </u>									
ĺ	- 1	22	} <u>-</u>	├		 			-		 					{	{					
-		N		┝╼┥		 		 -	\vdash													
l	- 1	•	-		ļ	 	 	├														
Į	- 1	00					$\vdash \vdash$	 -														
	- 1	9					$\vdash \vdash$					-									-	
	ار	•		-																		
1	∢	~	-														\dashv					
	-	9						-						-								
	- 1	ω																		\neg		
l	- [•																				_
L		47															_	_				
ē	Repe	7											7									
Γ	T																					
1	Element Number	~0																				
!	EE	a																				
2.3												}		_		-						
	wzj									_ •		•	'	,		•		•				

417



BAC 1530

MAGIC STRUCTURAL AMALYSIS SYSTEM INPUT DATA FORMAT

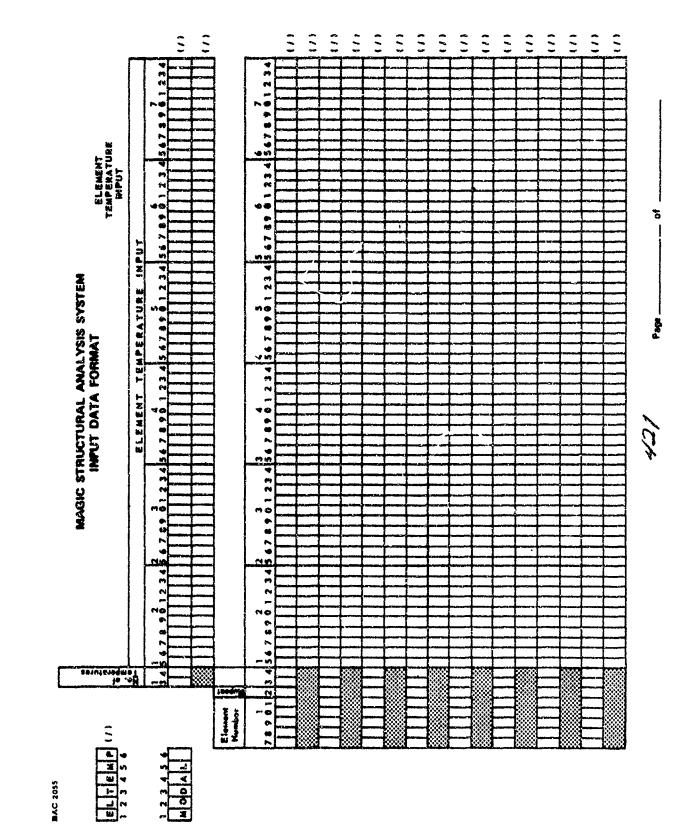
ROTATIONAL TRANSFORMATIONS (INPUT MATRICES)	Column Column 2 Column 3 Column 2 Column 3 Colum	COLUMN 1 COLUMN 2 COLUMN B	Column Celebra Column 3	COLUMN COLUMN 2 COLUMN 3 COLUM	TRAMBFORMATION MATRIX COLUMN 1 COLUMN 2 COLUMN 3 (1) (1) (1) (1) (1) (1) (1) (1) (1) (1)
MAGK STRUCTURAL AHALYSIS SYSTEM INPUT DATA FORMAT	- 2 3 4 6 7 6 9 :00 11 :2 13 :44	2 3 4 5 6 7 6 9 10 11 12 13 14 15 15 15 15 15 15 15 15 15 15 15 15 15	X	7 2 3 4 8 6 7 8 9 10 11 12 13 14 18 7 8 9 10 11 12 13 14 18 9 7 8 9 10 11 12 13 14 18	3 4 5 6 7 6 9 10 11 12 13 14 15 14 15 1
	2	SYSTEM Samber of RUMBER CityPersons 7 B S D D II II	SYSTEM Number of Applicable of	SYSTEN Member of Municipal Control of Municipal Con	8YSTEM Number of Applicable of Bulle E 6x4 Points 7 8 9 10 11 12 1

SS

The State of the S

;

47.0



(/) 7 3 111 : 3 (/) ... 3 () (/) 111 :: 5 2 Ξ 8 8 3 ELEMENT PRESSURE INPUT 1234 56789 4 78 9 5 1 2 3 4 5 6 7 8 9 5 1 2 3 4 5 6 7 8 9 MAGIC STRUCTURAL ANALYSES SYSTEM MAGIC STRUCTURAL ANALYSES SYSTEM ELEMENT PRESSURES 567690123 789 Element Number EL PRES (/) 12345 **6** BAC 2057

422

5 ----5 111 : (1) (1) 6/8 . . . (7) : 5 ~ : (/) 113 5 () 6 6 1 2 * A & & 4 . **#** Element Prestram/Prestress Infly 486789123 4 % & 7 % & 6 1 2 8 3 3 3 4 5 6 7 5 9 6 1 2 3 4 5 6 7 5 5 6 1 2 3 345678901234563898123 PRESTRAIN OR PRESTRESS 3 MAGIC STRUCTURAL ANALYSIS SYSTEM INPUT DATA FORMAT 423 **~** 0 456789 456789 37 20 ~0 ~0 456789 456785 7 8 9 0 1 2 nierrii e Element 3 S T S T BAC 2056 11

!

The state of the s

William Contraction

MAGIC STRUCTURAL ANALYSIS SYSTEM INPUT DATA FORMAT

;

TRIANGULAR RING ELEMENT (ASYMMETRIC LOADING) Harmonic increments

MSOC (/)

(comments)	2
FMC.	7 8 9 2 1
INC. VALUE	2 3 4 6 6
REF. VALUE	78 \$ 0 1

425

The state of the s

BAC 2055 Sht. 1

HARM

He. Hermoniss-Element oh Me. Hermanics-Survey -0 7 6 9 stneme!3 No. of Lossian

MAGIC STRUCTURAL ANALYSIS SYSTEM INPUT DATA FORMAT

TRIAHGULAR RING ELEMENT (ASYMMETRIC LOADING)

HARMONEC DEPENDENT ELEMENT PRESSURE LOADS

2 3 3 3 3 **?**; ?; <u>``</u> (/) ? * ~ 7 ~0 9 2 2 7 7 •= **⊕** 10 P * 2 3 4 PRESSURE LCAD VALUES 4 # 8 6 4 9 0 1 2 10 2 0123456 Ø 234567 ~0 4 3456 No. of Axial Leading Points No. of Redict Leceing Peints ~ neliq0 taeqeA -0 7 8

The second of the second secon

14, 4,414

ĕ

BAC 2059 Sht. 2

MAGIC STRUCTURAL ANALYSIS SYSTEM INPUT DATA FORMAT

HARMONIC DEPENDENT ELEMENT PRESSURE LOADS (CONTINUED)

}

		0	()		3		9	(/)	5	4 / 3	:	3	5	(1)	3	3	S	3	()	3	
	9	<u> </u>	1			Γ			1	T		Į	\				<u> </u>	1	·		_
	ស				-	_	 		 			-						1			
	*					-	·		ļ —		·	-		_			-				
	ო		 -				 -		†	├ ~			1					1	-		
]	~																	T —			Γ
i	-																				
ļ	~0																				L
1	9																L				L
	#		1																		L
	6 ~																				Г
ļ	•																				Γ
į	Ø		1	Γ^{-}																	Γ
	4			1					Ţ	1											Γ
	က																				Γ
	~																	ļ .			Γ
	***		1																		
									L												Γ.
	•																				Γ
	60		1																		Γ
	807									L											Γ
	9		L^{-}																		C
	10																				\Box
	4																				Γ
	u																				Γ
	~																				L
	-							L													
	N O																				L
m,	۵		<u> </u>		ļ	<u> </u>		L	L				<u></u>				Ц.,				L
ə i	**	L	ļ							Ļ											┞
1	47	L											L					L			L
VALUES	0		<u> </u>					ļ	L.,			L									L
	10	<u> </u>	!	ļ	L				ļ	<u> </u>								 			ļ.,
LOAD	4 6	 	ļ	 			<u> </u>	ļ	-			L									┡
0	7		 	<u> </u>				ļ	Н—			- -									┝
٠,	, F		├		<u> </u>	├	ļ	<u> </u>		-	<u> </u>	 								_	├-
w	40	 	├	-	ļ	 -			-	 - -		-									┢
PRESSUR	æ	├─	├	-		├─		┝		 		-									┝
n s	60	├	 	 					 -			 -									┝
8	8 -	<u> </u>	├─	 			├─			-	_	├									┝
82	9	-			 	 	├									_			-		┝
a.	9		₩	├			-		-			-				-			<u> </u>		┝
	4		ļ	 -	├			├													┝
	m	├	}							 											┝
	~	 	 	 				 	-	 -											┢
	-		1			1	T	T	·		$\overline{}$										Г
	80	Γ																			Γ
	a																				
	*																				Ľ
	42				L^-													L			\Box
	9				L																Γ
	ro C					<u> </u>															Γ
	*																				Г
	က																				Г
	~																				Ĺ
	-																				Г
	20			\Box																	Γ
	0			<u>L. </u>																	ſ
	80		\Box																		Γ
	7								L^-												Γ
staled galboed	9	-																			Ľ
iolxA lo .oh	**																				Γ
1-14 354																					Γ
Loading Points	ਲ	·	L				L											<u> </u>			Ĺ
Ho. of Rodial	7																				Ĺ
										ļ											Γ
Rapes: Option	~0																				Γ
Humber	6																				Γ
tnomu13	7 8																				Γ
,						•							1							i	1

427 Page of

The second of th

うななは、はないできょうことのなっていませんではないない

BAC 2058 5ht 1

3 HTEM

MAGIC STRUCTURAL ANALYSIS SYSTEM INPUT DATA FORMAT

TRIANGULAR RING ELEMENT (ASYMMETRIC LOADING)

() 78 2

themela-sainement .elf

Ho. of Looded Elements

Tego tsoces)a .e.M ensteneeme T strains

THERMAL LOAD VALUES

(/) \$ 18 113 111 1/3

428

a management organic (by many)

ELEMENT THERMAL LOADS HARMONIC DEPENDENT

4

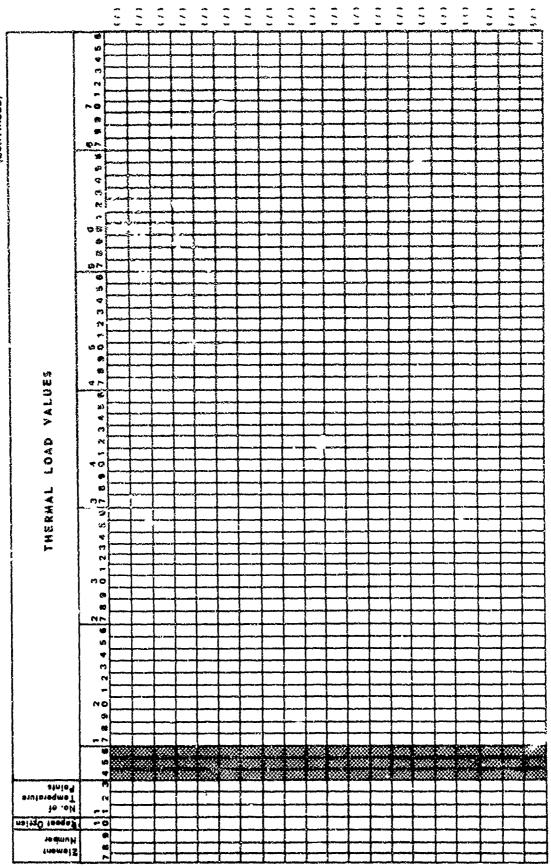
ð

THE PERSON NAMED IN

BAC 2058 Sht. 2

MAGIC STRUCTURAL ANALYSIS SYSTEM INFUT DATA FORMAT

Harmonic dependent Element Thermal Loads (Continued)



43.4

Sap.

A Contraction of the second of